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Development and Application of a Military Intelligence (MI) Job Comparison and Analysis Tool (JCAT)

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As part of a military intelligence MOS-intelligence/electronic warfare (IEW) analysis method, the Job Comparison and Analysis Tool (JCAT) was developed to identify MOS capabilities and IEW system demands in terms of abilities, skills, and intelligence production activities. Its origins can be found in the Manual for the Ability Requirements Scales (MARS) developed by E. A. Fleishman and associates. JCAT embodies flow diagram decision methods and scalars from this earlier work; the methodology has been expanded to address intelligence production activities. The technique has been used in a test application at the U.S. Army Intelligence Center and School (USAICS) at Fort Huachuca to collect abilities and skills data for the seven MOS comprising the 96 Career Management Field (CMF).

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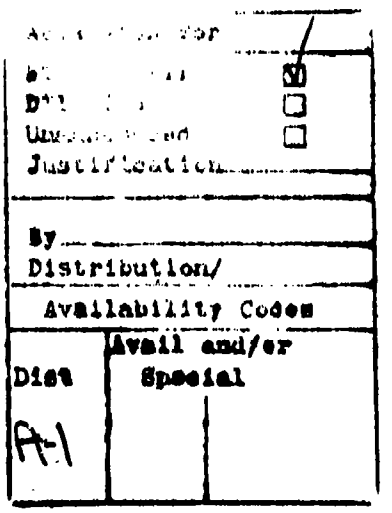

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FOREWORD

The Army's Military Intelligence (MI) Branch is fielding new intelligence/electronic warfare (IEW) systems. These will impose operation and maintenance demands on the soldier that have not been seen before. To ensure that intelligence missions are effective, there is a growing need for personnel proponents, training developers, combat developers, and equipment designers to match soldier capabilities and equipment requirements and, where necessary, identify training actions that improve the man-machine interface.

The U.S. Army Research Institute for the Behavioral and Social Sciences, through its Fort Huachuca Field Unit, has sponsored research to develop techniques and methods that evaluate the ability and skill capabilities and demands associated with MI Military Occupational Specialties and new IEW systems. The Job Comparison and Analysis Tool (JCAT) described in this report is an analytical technique that has been tailored to MI man-machine assessments. JCAT will form the foundation for basic analysis and provide data useful in identifying training and other initiatives to improve the match between soldier and equipment.

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DEVELOPMENT AND APPLICATION OF A MILITARY INTELLIGENCE (MI) JOB COMPARISON AND ANALYSIS TOOL (JCAT)

EXECUTIVE SUMMARY

Requirement:

New intelligence/electronic warfare (IEW) systems are being developed and fielded throughout the 90s. For this equipment to fulfill its missions and meet its capabilities, trained soldiers skilled in operations and maintenance must be available. There is a need for analysis methods that can determine the suitability of existing MI military occupational specialties (MOS) for meeting IEW system demands. Research sponsored by the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) is developing such methods.

Procedure:

As part of an MI MOS-IEW analysis method, the Job Comparison and Analysis Tool (JCAT) was developed to identify MOS capabilities and IEW system demands in terms of abilities, skills, and intelligence production activities. Its origins can be found in the Manual for the Ability Requirements Scales (MARS) developed by E. A. Fleishman and associates and the Job Abilities Software System (JASS) developed by P. Rossmeissl and others at ARI. JCAT embodies flow diagram decision methods and scalars from this earlier work; the methodology has been expanded to address an MI dimension in terms of intelligence production activities. The technique has been used in a test application at the U.S. Army Intelligence Center and School (USAICS) at Fort Huachuca to collect abilities and skills data for the seven MOS comprising the 96 Career Management Field (CMF).

Findings:

The research reported here resulted in findings in two areas. With regard to JCAT design and effectiveness

1. The test application of JCAT to the 96 CMF demonstrated its potential utility as a method for collecting abilities and skills data for MI MOS.

2. For enhanced value to USAICS, tailoring the generic MARS and JASS forms and procedures into JCAT with specific MI features is desirable.

3. Further development and test applications of JCAT with respect to MOS capabilities and IEW system demands are required.

With regard to findings pertaining to the 96 CMF, initial analysis of the abilities and skills data indicates

1. There is a common core of abilities and skills that can be found in each of the 96 CMF MOS.

2. Heavy requirements exist with respect to communication, conceptual, reasoning, and speed-loaded skills.

3. MOS involved with substantial and major equipment require psychomotor or gross-motor skills in addition to the core requirements.

4. Of eight intelligence production activities, "COLLECTING DATA" made the heaviest demands, although relative activity demand varies with MOS.

Utilization of Findings:

The findings with respect to the design and use of JCAT will be used to refine the method so that it may be used to collect abilities and skills data pertaining to MOS of the [illegible] CMF and 33 CMF. JCAT will also be used within the framework of MANPRINT and the materiel acquisition process to identify ability and skill requirements of new IEW systems. Ultimately, these data will be used with other MI-MOS analysis methods to determine the suitability of existing MOS to meet IEW system demands.

The 96 CMF data collected as a result of this effort represent a rich resource of abilities and skills data that can be used in a variety of important ways in addition to assessing MOS-IEW suitability. These include MOS comparisons, CMF evaluation, training evaluations, training needs assessments, and MOS structuring, among others.

DEVELOPMENT AND APPLICATION OF A MILITARY INTELLIGENCE (MI) JOB COMPARISON AND ANALYSIS TOOL (JCAT)

CONTENTS

CONTENTS (Continued)

LIST OF TABLES

CONTENTS (Continued)

CONTENTS (Continued)

Page

LIST OF FIGURES

DEVELOPMENT AND APPLICATION OF A MILITARY INTELLIGENCE (MI) JOB COMPARISON AND ANALYSIS TOOL (JCAT)

Requirements for MI Military Occupational Specialty (MOS) Analysis

MI MOS-Intelligence/Electronic Warfare (IEW) System Issues

The purpose of this research is to develop analytical methods that can be used to deal with MI MOS-IEW issues. The key MI MOS-IEW issue that is being addressed here is

> What existing, modified, or new MOS are best suited to operate and maintain existing and emerging IEW equipment?

"MI MOS-IEW issues," in the present context, are issues concerning the relationship between MI MOS requirements and equipment characteristics, task demands, organizational structure, and other manpower, personnel, and training (MPT) variables. Developing answers to these issues ultimately involves considerations pertaining to man-machine interfaces, personnel characteristics, equipment design, training, occupational structure, organization, doctrine, equipment, and force structure, among other concerns.

The issues today are framed in the Army Intelligence Master Plan (AIMP), as well as the Draft MI 2000 White Paper being prepared for the Deputy Chief of Staff for Operations (DCSOPS). In addition to changes in traditional MI missions, there may be new missions as well. In terms of the soldier, these changes mean the MI job will become much harder. More work will have to be accomplished with fewer soldiers. Increased understanding of electronics and computers will be necessary in order to use MI technology. To operate effectively in the projected AIMP environment, the soldier will have to meet increasingly more difficult job demands. Training will be more critical for skill acquisition and retention. The Draft MI 2000 White Paper asserts that training will be a critical requirement if the Army is to leverage the technology required to meet its MI needs.

Requirements and Uses of an MI MOS-IEW Analysis Method

Despite the need, there are few analytical methods available for systematically and quantitatively assessing and evaluating MI MOS-IEW issues. There is need for an "MI MOS-IEW analysis method" that Army personnel and training planners as well as the combat developers can use in place of the less systematic steps they often take in the face of urgent decision requirements. An MI MOS-IEW analysis method constitutes a set of tools and related databases that can be used to define, analyze, and develop answers to the critical MOS-IEW issues facing the MI branch.

Requirements for an MI MOS-IEW Analysis Method. An MI MOS-IEW analysis method must meet four requirements. First, the method must be helpful in defining the scope and parameters of MI MOS-IEW issues. These issues usually are complex, engaging a variety of different concerns including personnel characteristics, task composition, training impacts, and mission performance, among others. Therefore, the method must provide an ability to frame the MOS-IEW issue effectively so key parameters and tradeoffs can be addressed.

Second, the method must be able to identify soldier capabilities in terms that can be used to address a variety of job performance questions. In particular, there is a need to be able to describe soldier capabilities in relation to personnel characteristics.

Third, the method must be able to identify IEW system demands in terms of the job performance requirements necessary to operate and maintain existing and new IEW equipment at a level appropriate for meeting mission requirements. For purposes of addressing MI MOS-IEW issues, the method must be able to translate equipment-oriented features into terms suitable for assessing soldier impacts.

Finally, the MI MOS-IEW analysis methods must provide a means to crosswalk between soldier capabilities and IEW system demands. Can existing MOS provide the capabilities required to operate and maintain new IEW systems? Do the demands of new systems require changes in the task composition of existing MOS? What training demands are created as result of fielding new IEW systems? In sum, when is there a match between system demands and soldier capabilities and when is there a mismatch? And, when a mismatch occurs, how can the MOS capabilities and IEW system demands be made compatible?

Uses of an MI MOS-IEW Analysis Method. There are many potential uses of an MI MOS-IEW analysis method. Of immediate interest are its uses to assess the suitability of MI MOS to operate and maintain new IEW equipment and to identify training needs.

Much of the demand to address MI MOS issues relates to ensuring that MOS exist to support the introduction of new IEW systems. To address these issues, all of the features associated with the analysis method are critical: problem definition, MOS analysis, IEW system demands, and equipment-soldier crosswalks. The IEW system acquisitions currently underway as well as the projections reflected in existing MI plans including the AIMP accentuate the need for carefully matching system demands and soldier capabilities.

The analysis method also will have an important role in assessing training needs. By its very nature, the method should facilitate the identification of job performance requirements and assessments of soldier capabilities. Gaps point to potential training needs. The method should provide a systematic and quantitative way to define training requirements in order to meet IEW system demands.

In addition to these two uses which are a focus of this research, there are potentially many others. These include evaluating MOS and career management field (CMF) structures and redesigning or restructuring existing MOSs and CMFs.

MI MOS-IEW Analysis Framework and Taxonomy

Figure 1 presents a conceptual framework for the MI MOS-IEW analysis method. There are three critical dimensions to the method which ultimately provide the capability to assess the suitability of soldier capabilities to meet IEW system demands.

First, there is a need to systematically identify and quantify soldier capabilities in terms of the existing MOS and CMF supply. Second, there is a need to identify the IEW system demands in a similar fashion. For these purposes, both the capabilities and demands must be specified in terms of job performance characteristics. Third, methods are needed to crosswalk between soldier capabilities and equipment demands, determining whether "good" matches exist or not.

A key to this analysis framework is an MI MOS taxonomy which identifies dimensions for defining job performance characteristics which can be used to relate equipment demands and soldier capabilities. Table 1 presents such a taxonomy. The taxonomy is based on a sequential process starting with micro-level dimensions directly bearing on the soldier's tasks and leads to macro-level variables highlighting impact on MOS aggregates and the CMF (Muckler, Seven, & Akman, 1990a).

An Initial Focus: A Technique for Assessing Abilities and Skills

To build an MI MOS-IEW analysis method, there are requirements for the specification, development, and demonstration of many analytical components. The MI MOS taxonomy identifies many attributes, all of which have varying degrees of importance depending upon the specific issue being addressed.

In this research, "abilities and skills" has been selected as a point of departure because of (1) its importance in describing both soldier capabilities and equipment demands, (2) the absence currently in the MI community of any systematic method for

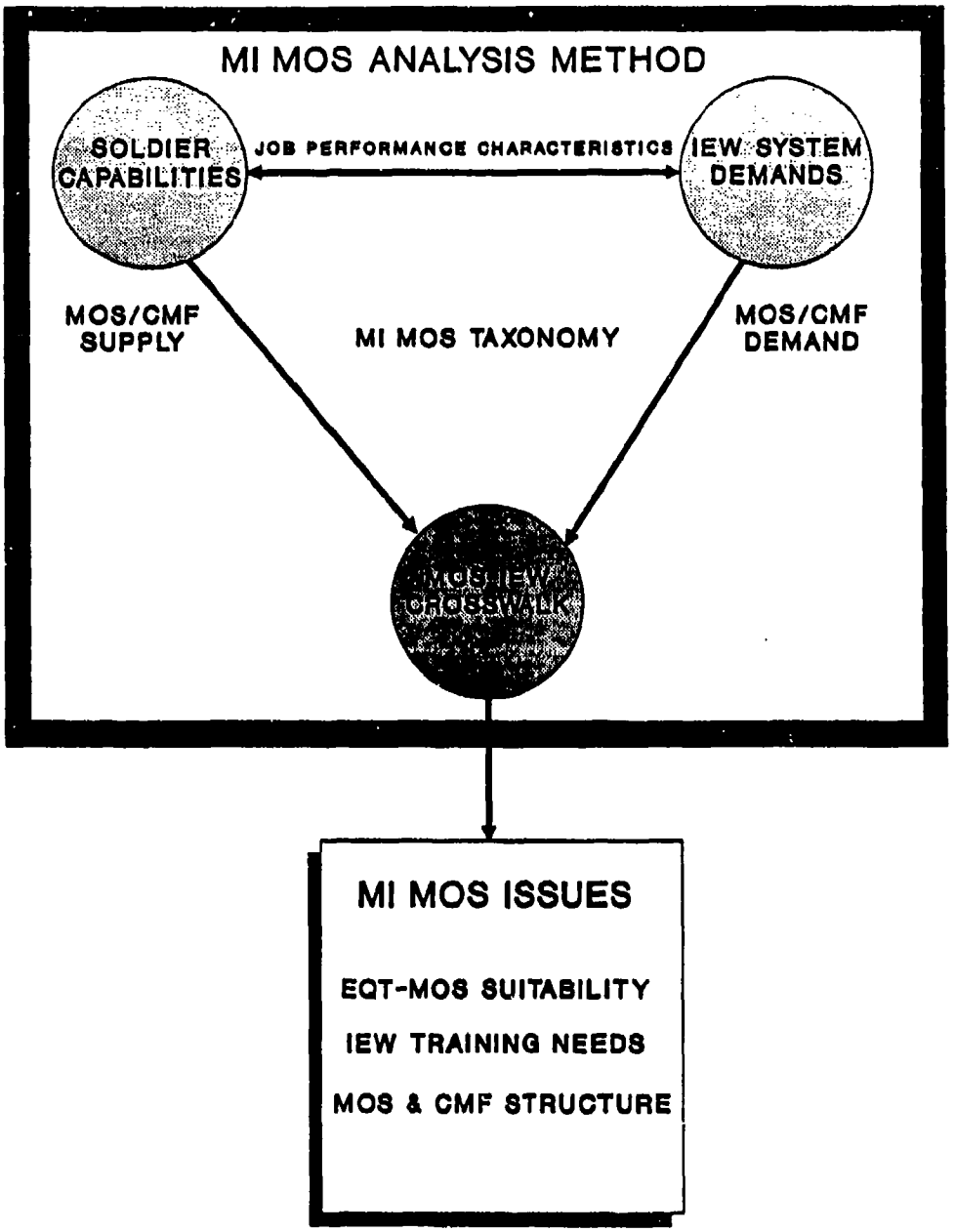


Figure 1. Conceptual framework for MI MOS-IEW analysis method.

Table 1

A Taxonomy for Evaluating MOS Issues

I. JOB-LEVEL VARIABLES

- A. CRITICAL TASK VARIABLES
  - 1. Workload Demands
  - 2. Physical Demands
  - 3. Skill Requirements
  - 4. Adverse Environments
  - 5. Organizational Requirements
  - 6. Performance Requirements
- B. SOLDIER CHARACTERISTICS
  - 1. Educational Requirements
    - a. Educational Level
    - b. Reading Level
  - 2. Mental Category
  - 3. Physical Abilities (PULHES)
  - 4. Abilities and Skills
    - a. Cognitive Abilities
    - b. Perceptual Abilities
    - c. Psychomotor Abilities
    - d. Flexibility and Coordination
    - e. Strength and Stamina
  - 5. Work Attitudes
    - a. Work Orientation
    - b. Dependability
  - 6. Special Requirements

II. MOS-LEVEL VARIABLES

- A. SELECTION (ASVAB) CRITERIA
- B. TRAINING REQUIREMENTS
- C. ACCESSION RATES
- D. RETENTION RATES
- E. PAYGRADE DISTRIBUTION

III. CMF-LEVEL VARIABLES

- A. TRAINING REQUIREMENTS
- B. ACCESSION RATES
- C. RETENTION RATES
- D. PAYGRADE DISTRIBUTION
- E. CAREER FIELD STRUCTURE AND MANAGEMENT

producing such descriptions, and (3) the body of past research providing a strong theoretical basis for methodological development.

Developing the slice of an MI MOS-IEW analysis method that focuses on abilities and skills will provide a sound foundation for further methodological development. At the same time, that portion of the analysis method can have immediate utility for the Army in beginning to assess MI MOS-IEW issues. What will remain from a research perspective is a requirement for additional techniques for analyzing other taxonomic dimensions as well as methods for assessing tradeoffs among the various parameters.

This report focuses on the development of a technique for systematically and quantitatively assessing the abilities and skills associated with existing MOSs and emerging IEW systems. The technique is called the "MI Job Comparison and Analysis Tool," or JCAT.

Development of JCAT: Methodological, Psychometric, and Conceptual Issues

In the research which has been undertaken to describe human job performance, most efforts can be associated with one of four basic approaches: the behavior description approach, the behavior requirements approach, the ability requirements approach, and the task characteristics approach (Fleishman & Quaintance, 1984, p. 55). Searching for a systematic and quantitative method with which to address abilities and skills with respect to MI MOS-IEW issues, initial efforts were grounded in the ability requirements approach out of which JCAT has been developed.

Once criteria were established, the literature yielded an existing method, the Manual for Abilities Requirements Scales (MARS) (Fleishman & Quaintance, 1984, Appendix B), as an appropriate foundation. Some modifications were needed for this application. The flow diagram approach already available for 40 abilities had to be expanded to 52 abilities; that expansion became Part A of the test instrument. Scales for quantifying each ability were adapted from the same source; these scales became Part B of the test instrument. These two parts were then pre-tested for two MOSs using a panel of 13 raters. In analyzing the results of the pre-test, the abilities were clustered into subsets to make them more tractable. The results of the pre-test were reported in an earlier document (Muckler, Seven, & Akman, 1990b). Additional data from that pre-test are included in this chapter where pertinent to a specific issue.

Based on the results of the pre-test, changes in wording, in number of abilities, and in sequence of abilities were made in Part A, Part B was given an additional set of anchors and was restructured, and Part C was added to obtain information relevant to eight intelligence production activities. The revised test instrument, Parts A, B, and C, was used to collect data on all seven MOSs in the 96 CMF. Data from 65 subject matter experts (SMEs) were obtained and are presented and discussed in the next chapter. The rest of this chapter discusses in greater detail the methodological, psychometric, and conceptual issues that arose, and the resolutions that were adopted, during the various stages of the development of JCAT.

Selecting an Appropriate Method

From the technology of industrial/organizational and engineering psychology, there were many candidate tools and methods that could have been used for this program (cf., Fleishman & Quaintance, 1984). In selecting an appropriate method, a key decision step was the specific focus for the initial effort. A taxonomic effort (Muckler, Seven, & Akman,

1990a) had identified 12 major dimensions at the job level alone for a set of military intelligence jobs.

It was possible to develop an instrument that either made an attempt to cover all 12 major variables, some subset of the 12, or concentrate on one of the 12. The latter approach was chosen. Emphasis was placed on ability and skill requirements. Measurement of ability and skills was required from two points of view:

1. The method had to be able to extract the ability and skill requirements and demands from new IEW systems and jobs, and

2. The method had to be able to specify the ability and skill capabilities of existing MI soldiers.

Thus, the method had to assess both job demands and personnel capabilities.

The MARS Method: Choosing the Abilities Set

More than a quarter century of research aimed at developing the ability requirements approach has occurred by now. Much of the recent work has been done as part of the Taxonomy Project, partially sponsored by the Army Research Institute (ARI). The results of this research are reflected in four areas that are relevant to JCAT and discussed below: (1) identification and definition of abilities and skills, (2) techniques for determining the presence or absence of abilities and skills as required for task performance, (3) methods for measuring how much of the abilities and skills are necessary, and (4) decision aids in estimating ability requirements.

Identification and Definition of Abilities and Skills. A key element in developing a method is establishing the abilities and skill taxonomy which will provide the framework for analysis. There are several taxonomies that could serve this function with well-defined and empirically based dimensions. The most useful, however, appears to be MARS developed by Fleishman and his associates. The 1984 version of MARS has 52 defined dimensions, all measurable, which are shown in Table 2.

This taxonomy was selected for a number of reasons: First, it has been widely tested and used in a wide variety of civilian and military jobs and tasks. Second, it has been extensively used for a considerable number of military jobs and systems, including the Howitzer Improvement Program (HIP) and the Stinger missile, among others. Third, analytical methods are available

Table 2

MARS* Abilities and Skills Dimensions

1.	ORAL COMPREHENSION	27.	GLARE SENSITIVITY
2.	WRITTEN COMPREHENSION	28.	GENERAL HEARING
3.	ORAL EXPRESSION	29.	AUDITORY ATTENTION
4.	WRITTEN EXPRESSION	30.	SOUND LOCALIZATION
5.	MEMORIZATION	31.	SPEECH HEARING
6.	PROBLEM SENSITIVITY	32.	SPEECH CLARITY
7.	ORIGINALITY	33.	VISUALIZATION
8.	INDUCTIVE REASONING	34.	STATIC STRENGTH
9.	CATEGORY FLEXIBILITY	35.	EXPLOSIVE STRENGTH
10.	DEDUCTIVE REASONING	36.	DYNAMIC STRENGTH
11.	INFORMATION ORDERING	37.	TRUNK STRENGTH
12.	MATHEMATICAL REASONING	38.	STAMINA
13.	NUMBER FACILITY	39.	EXTENT FLEXIBILITY
14.	FLUENCY OF IDEAS	40.	DYNAMIC FLEXIBILITY
15.	TIME SHARING	41.	GROSS BODY EQUILIBRIUM
16.	FLEXIBILITY OF CLOSURE	42.	SPEED OF LIMB MOVEMENT
17.	SPEED OF CLOSURE	43.	GROSS BODY COORDINATION
18.	SELECTIVE ATTENTION	44.	MULTI-LIMB COORDINATION
19.	PERCEPTUAL SPEED AND ACCURACY	45.	WRIST FINGER SPEED
20.	SPATIAL ORIENTATION	46.	FINGER DEXTERITY
21.	NEAR VISION	47.	MANUAL DEXTERITY
22.	FAR VISION	48.	ARM HAND STEADINESS
23.	NIGHT VISION	49.	CONTROL PRECISION
24.	VISUAL COLOR DISCRIMINATION	50.	RATE CONTROL
25.	PERIPHERAL VISION	51.	REACTION TIME
26.	DEPTH PERCEPTION	52.	CHOICE REACTION TIME

* Fleishman, E. A. & Quaintance, M.K. (1984) Taxonomies of human performance: The description of human tasks. Orlando: Academic Press

to extract information about each of these abilities from narrative descriptions of the tasks for new systems; empirical measurement is not essential. Fourth, the methods associated with MARS have been shown in previous applications to give high reliability for the identification of abilities and skills that may be needed for new IEW system tasks. Fifth, the information derived can be compared with the capabilities of the existing and appropriate MOSs which might be called upon to perform the new IEW system jobs and tasks.

Techniques for Determining Ability and Skill Requirements. Coincident with the development of an abilities and skills taxonomy has been the formulation of ability rating procedures. Generally, these techniques have focused on the use of task descriptions by raters who make judgements whether an ability is present or absent in a given task. Experimentation has led to greater specificity in the ability definitions, expansion of the abilities list, and more precise measurement, all of which has been incorporated in MARS (Fleishman & Quaintance, 1984, p. 315).

Methods for Rating How Much Ability is Required. Almost in parallel with the question of whether or not an ability is required came the question, "How much?" Ability rating scales have been the focus of considerable research. An initial approach was based on rating the abilities as "not involved," "baseline," or "critical." Results from this approach have led to refinements ultimately based on a seven point behaviorally anchored scale in which high, low, and middle level task examples are provided as anchors (Theologus, Romashko, & Fleishman, 1973).

Research supports three conclusions regarding the utility of the scaling methodology which has been developed as part of the ability requirements approach. First, the seven point scale with high and low anchors is a statistically reliable tool for assessing amount of ability required. Second, having personnel experienced with the task being rated is not an essential prerequisite for using the scales. And third, the rating technique can be used by raters without specific expertise in psychological assessment methods (Fleishman & Quaintance, 1984, p. 321).

Decision Aids for Estimating Ability Requirements. A decision aid based on binary flow diagrams for 40 of the abilities listed in Table 2 had been developed by which an abilities profile could be derived for any human job or task that can be described in a narrative summary (Mallamad, Levine, & Fleishman, 1980). The basic form of this method consists of flow diagrams incorporating questions which ask the rater to identify the presence or absence of need for an ability. The diagrams are supplemented by a scaling procedure to address the "amount" of the abilities required. A computer version of this methodology was later developed to further promote the utility of this approach; this

has been called the "Job Assessment Software System (JASS)," used for analysis of weapon systems personnel requirements (Rossmeissl, et al., 1983).

Both the earlier flow diagram form and the computer-based methods, however, were based on only 40 of the abilities and skills listed in Table 2. The flow diagram format had to be expanded to include all 52 MARS dimensions. After the pre-test, the number of abilities was reduced from 52 to 50 to remove what appeared to be unnecessary repetition. The result is presented in Appendix A.

A crucial point was that the method had to provide compatible dimensions and easily transformable variable language for demand and capabilities evaluation. The language describing one had to be easily transformed into the language of the other. By selecting MARS, this problem was minimized, since both demands and capabilities can be evaluated using the same set of dimensions.

Two penalties were paid by selecting an evolution of MARS for this project. First, MARS is restricted to abilities and skills. Other techniques, such as McCormick's Position Analysis Questionnaire (PAQ), have a much broader scope, although the PAQ does not deal directly with or measure job abilities and skills. (See Peterson & Bownas, 1982).

Second, it is traditional in this context to try and extract "KSA" or knowledge, skills, and abilities; MARS is well-suited for the last two, but does not attempt to measure knowledge relevant to a job or possessed by an individual performing that job. Yet it is probable that in actual job performance many of the MARS abilities are very much intertwined with knowledge, whether it is domain knowledge (knowledge of data, facts, etc.) or procedural knowledge (knowledge of rules for using facts and data).

Future work will be needed to add "knowledge" to the measuring technique. It is unfortunate that there appear to be very few well-developed ways of extracting knowledge in skill acquisition in such theories as cognitive engineering (see Rasmussen, 1986).

Clarifying Two Pairs of Abilities

Subsequent reexaminations of the list of 52 abilities suggested that a possible redundancy existed in two pairs of abilities:

- ORAL COMPREHENSION (#1) and SPEECH HEARING (#31)
- ORAL EXPRESSION (#3) and SPEECH CLARITY (#32)

Considering the definitions of these abilities reinforces an impression of redundancy:

ORAL COMPREHENSION:	The ability to understand spoken English words and sentences.
SPEECH HEARING:	The ability to learn and understand the speech of another person.
ORAL EXPRESSION:	The ability to use English words or sentences in speaking so that others will understand.
SPEECH CLARITY:	The ability to communicate orally in a clear fashion understandable to a listener.

The first pair deals with understanding speech. The second pair deals with producing understandable speech. Are the two members of each pair evaluating the same thing? Are both members of each pair adding something useful, or could the list of abilities be reduced without losing important data?

One way of answering is to look at the questions posed. In judging the need for ORAL COMPREHENSION, the rater is asked whether or not it is "necessary to listen to and understand spoken English sentences." The question for SPEECH HEARING is "Is it necessary to understand the speech of another person?" Aside from the specification of English as the language in one case and not in the other, the questions being asked are much the same. In one case "listen to" is explicit, and in the other it is implicit, but certainly having to "listen to and understand" speech is the issue in both cases. To assess the need for ORAL EXPRESSION, a rater is asked whether or not it is necessary to "communicate through speaking so that others will understand." In judging the need for SPEECH CLARITY the rater is asked whether or not it is "necessary to speak in a clear fashion understandable to a listener." For this latter pair, the basic issue is speaking understandably. Perhaps in its emphasis on clearness, SPEECH CLARITY could be seen as a more narrowly defined ability, but it is a distinction that seems unlikely to produce a difference in judgement. Within each pair of abilities, either both abilities would seem to be needed or neither.

Another way of answering these questions is to look at the responses of the 13 raters for the two sample MOSs used in the feasibility test of the tool (Muckler, Seven, & Akman, 1990b). Table 3 summarizes the data obtained. For the first part of the assessment, the identification of necessary abilities, the

Table 3

Rater Responses in Using Abilities (1,31) and (3,32)

MOS	STATISTIC	ABILITY MATCH		ABILITY MATCH	
		1	31	3	32
97E:	NUMBER OF RATERS	13	13	13	13
97E:	MEAN	5.8	5.5	5.5	5.5
97E:	STANDARD DEVIATION	0.4	0.9	0.8	0.7
97E:	VARIANCE	0.2	0.8	0.6	0.5
96H:	NUMBER OF RATERS	12	12	13	13
96H:	MEAN	4.7	5.0	5.2	5.2
96H:	STANDARD DEVIATION	0.9	0.9	1.1	0.8
96H:	VARIANCE	0.8	0.9	1.2	0.6

responses were redundant. In evaluating 96H, 12 of the 13 raters considered ORAL COMPREHENSION necessary, and the same 12 said SPEECH HEARING was needed. In evaluating 97E, all 13 raters included both abilities. With respect to ORAL EXPRESSION and SPEECH CLARITY, both were selected for both MOSs by all 13 raters. Thus, there was no case in which a rater picked one member of a pair but not the other. On the basis of these data, it appears that one member of each pair could be eliminated without loss of needed information.

The summary statistics for both pairs indicate a high agreement between the values assigned to one member of a pair and those assigned to the other. The slight distinctions discussed above, the narrower focus of the SPEECH HEARING and SPEECH CLARITY questions, could be expected to produce slight differences in the values assigned to the abilities. The data indicate that raters made distinctions, although small ones, when judging how much the ability was needed.

A third way of looking at this problem is to compute correlations between the pairs of abilities for each MOS and all subjects in the pre-test data. Product moment correlations are shown in Table 4 for 97E, 96H, and all pre-test subjects combined. Further, correlations are computed for (1,31) and (3,32) ability pair comparisons. If the pairs are measuring the same thing, then the correlations should be very high. Between ORAL COMPREHENSION and SPEECH HEARING, the correlations are reasonably high, but between ORAL EXPRESSION and SPEECH CLARITY, lower correlations are recorded. These data suggest that the pairs have considerable overlap and common variance but that there may be some unique variances associated with each. Much more methodological data would be needed to settle this point.

However, it seems reasonable to conclude from all of this that SPEECH HEARING is included in ORAL COMPREHENSION, that SPEECH CLARITY is included in ORAL EXPRESSION, and that raters evaluated them consistent with that conclusion. Therefore, in refining the method, and in the interest of keeping the evaluation procedure as concise and brief as possible, the number of abilities included in the assessment was reduced from 52 to 50. ORAL COMPREHENSION and ORAL EXPRESSION were retained; SPEECH HEARING and SPEECH CLARITY were dropped. Fleishman and Mumford (1989) have also dropped these same two abilities from the latest MARS listing of abilities, so it also stands at 50 abilities.

Ordering and Clustering Abilities

Related to the issue of which abilities the assessment tool should include is the question of how those abilities should be grouped or clustered, if at all. Trying to consider 50 individual abilities without some categorizing can present a formidable challenge. If like abilities can be grouped, drawing

Table 4

Correlations between Paired Abilities

SUBJECT SAMPLE	ABILITY COMPARISONS	
	1 - 31	3 - 32
97E	r = .59	r = .25
97H	r = .88	r = .68
All Ss	r = .81	r = .52

conclusions from the data may be made somewhat easier. To try to provide help in structuring the results, a tentative set of eight clusters was formulated:

COMMUNICATION ABILITIES
CONCEPTUAL ABILITIES
REASONING ABILITIES
SPEED-LOADED ABILITIES
PERCEPTUAL ABILITIES: VISION
PERCEPTUAL ABILITIES: AUDITION
PSYCHOMOTOR ABILITIES
GROSS MOTOR ABILITIES.

Although useful because they made it possible to think in terms of an area of abilities (e.g., Communication Skills) rather than separate individual abilities (ORAL COMPREHENSION, WRITTEN COMPREHENSION, etc.), this first version of clustering contained some inconsistencies, some imbalances, and some possible redundancies (the latter discussed in the preceding section). Further consideration of the relationship between abilities led to a re-assignment of some abilities within the eight clusters. A listing of these revised clusters and of the abilities grouped within them is shown in Table 5.

Once the clusters had been revised, it was decided for the sake of consistency, ease of administration and analysis, and coherence of topics treated, that the order of the questions in the flow diagrams should be changed to match the order of abilities shown in the table. Before this decision was made, some questions had to be addressed: Does the order in which the abilities are presented make any significant difference in rater responses? Should the abilities be presented in random order without regard to the relationships between them? For example, should the questions dealing with visual abilities be together, or should they be scattered throughout the diagram pages? No data are available to answer these questions. However, experience with the method suggests that the order of abilities is not critical.

A more efficient presentation is achieved by clustering questions according to their focus (verbal, cognitive, visual, etc.). A detailed inspection of the questions contained in the flow diagrams of the first part of the assessment package revealed an interdependency between the questions. Preliminary questions set the stage for questions directed to more than one ability. If the order of presentation was randomized, the preliminary questions would have to be repeated for each of the subsequent dependent questions. While it would be possible to treat each question independently, the repetition would result in a considerably expanded instrument. Clustering the abilities achieves an efficiency of presentation. Words, space, and rater's time are saved. The instrument is fairly long, and

Table 5

Revised List of Abilities and Clusters

COMMUNICATION SKILLS:	1.	Oral Comprehension
	2.	Written Comprehension
	3.	Oral Expression
	4.	Written Expression
CONCEPTUAL SKILLS:	5.	Memorization
	6.	Problem Sensitivity
	7.	Originality
	8.	Fluency of Ideas
	9.	Flexibility of Closure (Pattern Recognition)
	10.	Selective Attention
	11.	Spatial Orientation
	12.	Visualization
REASONING SKILLS:	13.	Inductive Reasoning
	14.	Category Flexibility
	15.	Deductive Reasoning
	16.	Information Ordering
	17.	Mathematical Reasoning
	18.	Number Facility
SPEED-LOADED SKILLS:	19.	Time Sharing
	20.	Speed of Closure
	21.	Perceptual Speed and Accuracy
	22.	Reaction Time
	23.	Choice Reaction Time
PERCEPTUAL SKILLS: VISION	24.	Near Vision
	25.	Far Vision
	26.	Night Vision
	27.	Visual Color Discrimination
	28.	Peripheral Vision
	29.	Depth Perception
	30.	Glare Sensitivity
PERCEPTUAL SKILLS: AUDITION	31.	General Hearing
	32.	Auditory Attention
	33.	Sound Localization
PSYCHOMOTOR SKILLS:	34.	Control Precision
	35.	Rate Control
	36.	Wrist Finger Speed
	37.	Finger Dexterity
	38.	Manual Dexterity
	39.	Arm Hand Steadiness
	40.	Multi-Limb Coordination
GROSS MOTOR SKILLS:	41.	Extent Flexibility
	42.	Dynamic Flexibility
	43.	Speed of Limb Movement
	44.	Gross Body Equilibrium
	45.	Gross Body Coordination
	46.	Static Strength
	47.	Explosive Strength
	48.	Dynamic Strength
	49.	Trunk Strength
	50.	Stamina

making it longer still so that the abilities could appear in random order was deemed unnecessary, and inappropriate in the present context. But the question of the actual impact, if any, of the order of presentation of abilities could only be answered experimentally by a large methodological study comparing different sequences of abilities.

When the number of abilities was expanded from 40 to 52 in preparing the flow diagrams for the pre-test, the question of placement of the additional abilities had arisen. As a temporary expedient, the 12 additions were inserted between SPATIAL ORIENTATION and VISUALIZATION. The new additions all dealt with perceptual skills, and the then-existing 40 abilities flow diagram set contained a boxed interjection saying that "Most tasks require the person to attend to, perceive, and evaluate sensory information in the environment. This information is usually in the visual or auditory modes. The 200-level questions refer to this sensory information." Therefore, it was judged appropriate to insert the new abilities in that section of questions. They were put on the pages immediately preceding the switch from 200-level to 300-level questions. The inserted abilities became numbers 21 through 32 in the pre-test packages.

In revising Part A after the pre-test, the issue of explanatory boxes such as the one just described arose once the decision had been made to group abilities according to cluster. In the early diagrams, there was only one explanatory box, the one talking of sensory information. Either that box had to be dropped or additional boxes explaining each of the other clusters had to be generated. It was decided that whatever orienting value such boxes had for raters was more than offset by the disadvantages of including them. Using such boxes at the beginning of each cluster would not only interrupt the flow of the questions, it would also increase the length of the instrument and the time required to work through it. The questions in the diagrams themselves provide adequate orientation. Therefore, the existing explanatory box was dropped from the revised version of the diagrams, and the clusters were used as an ordering scheme but were not discussed as part of the presentation of abilities.

In addition to changes occasioned by the re-ordering of abilities to conform to the order of clusters, some of the pathways within the diagrams were restructured to reflect consideration of how and when raters should be routed around certain ability questions rather than having to read and answer each one. For example, if a rater judges that in performing a task it is not necessary to know and use language, it is reasonable to route that rater around the questions asking about reading, writing, and speaking language. In effect, we presume that if a rater says "no" to language use, that rater would also say "no" to the use of written or spoken versions of language,

and to ask him to respond to questions already asked and answered would reduce the acceptability of the instrument to the rater as well as its efficiency. Therefore, certain "no" responses were used as a by-pass criterion.

There were other instances in the earlier version of the instrument in which answering "yes" to one ability precluded the rater's being asked the qualifying questions for another ability. For example, if the pathway was carefully followed, a rater selecting REACTION TIME would never be asked questions relating to CHOICE REACTION TIME. An examination of the data from the 13 raters in the pre-test showed that at least three raters (three of the four Army raters and both of the MI SMEs) chose both REACTION TIME and CHOICE REACTION TIME as necessary for tasks in MOS 96H. Since none of the other raters selected both of these abilities for 96H, and since no raters selected either of these two abilities as necessary for MOS 97E, these other raters may or may not have followed the prescribed pathways strictly. Nonetheless, the three raters most familiar with the jobs they were rating (the two MI SMEs and the MI training specialist) let their understanding of the job take precedence over the technicalities of the flow diagrams. This judgement seemed sound and so the entire set of diagrams was reviewed, and revisions were made in them so that raters no longer need choose between the realities of the job and the requirements of the question-presentation format. There may be job contexts in which the focus of the task being rated is so narrow that a choice should be made between closely related abilities (e.g., between REACTION TIME and CHOICE REACTION TIME), but the MI MOSs and the IEW systems realm is probably not such a context. In short, within a complex job or task, it is possible that both may be required at one time or another.

The latest version of the flow diagram method for identifying abilities and skills, incorporating all of the changes discussed here and used for the seven MOSs in the 96 CMF data collection, is the one included as Appendix A.

Selecting Level of Rater Agreement

One of the critical steps in using the results from the instrument is the choice of what proportion of the raters must select a given ability as required for the job or task in order for that ability to be included in the profile used to characterize the job or task. Table 6 shows the effect of this choice on the profile for MOS 96H based on the selections made by 13 raters during the pre-test. One has to pick the level of agreement (number of raters agreeing) to determine which abilities are to be included in the profile of abilities. From

Table 6

MOS 96H Abilities and Skills--Ordered by "Yes" Responses and Means

	ABILITIES	YES	MEAN	SD	VAR
22	FAR VISION	13	5.7	1.5	2.1
15	TIME SHARING	13	5.5	0.8	0.6
16	FLEXIBILITY OF CLOSURE	13	5.5	0.9	0.8
2	WRITTEN COMPREHENSION	13	5.3	1.2	1.4
3	ORAL EXPRESSION	13	5.2	1.1	1.2
32	SPEECH CLARITY	13	5.2	0.8	0.6
23	NIGHT VISION	13	5.1	0.6	0.3
20	SPATIAL ORIENTATION	13	5.1	0.7	0.5
6	PROBLEM SENSITIVITY	13	4.9	1.0	1.0
10	DEDUCTIVE REASONING	13	4.9	1.0	1.0
19	PERCEPTUAL SPD & ACCURACY	13	4.9	0.8	0.7
5	MEMORIZATION	13	4.6	1.3	1.7
18	SELECTIVE ATTENTION	13	4.6	0.9	0.8
24	VISUAL COLOR DISCRIMINATION	13	4.4	1.4	2.1
49	CONTROL PRECISION	13	3.9	0.7	0.5
13	NUMBER FACILITY	13	3.7	1.2	1.4
46	FINGER DEXTERITY	13	3.5	1.2	1.4
31	SPEECH HEARING	12	5.0	0.9	0.9
11	INFORMATION ORDERING	12	4.9	1.4	1.9
21	NEAR VISION	12	4.8	0.9	0.8
1	ORAL COMPREHENSION	12	4.7	0.9	0.8
27	GLARE SENSITIVITY	12	4.3	1.3	1.8
47	MANUAL DEXTERITY	12	4.0	1.0	1.1
44	MULTI-LIMB COORDINATION	12	3.8	1.0	1.1
33	VISUALIZATION	11	5.2	0.8	0.6
52	CHOICE REACTION	11	4.6	0.9	0.8
25	PERIPHERAL VISION	11	4.2	0.5	0.3
39	EXTENT FLEXIBILITY	11	3.8	1.0	1.0
8	INDUCTIVE REASONING	10	5.1	1.0	1.0
12	MATHEMATICAL REASONING	10	4.7	0.9	0.9
26	DEPTH PERCEPTION	10	4.6	1.3	1.6
4	WRITTEN EXPRESSION	10	4.5	1.2	1.5
14	FLUENCY OF IDEAS	10	4.4	1.3	1.8
9	CATEGORY FLEXIBILITY	10	4.2	1.1	1.2
34	STATIC STRENGTH	10	3.8	0.6	0.3
48	ARM HAND STEADINESS	10	3.2	1.1	1.2
28	GENERAL HEARING	9	4.5	0.4	0.2
45	WRIST FINGER SPEED	9	3.0	1.4	2.1
29	AUDITORY ATTENTION	8	5.5	0.6	0.3
17	SPEED OF CLOSURE	8	5.0	1.0	1.1
7	ORIGINALITY	8	4.4	1.1	1.2
50	RATE CONTROL	7	4.5	0.7	0.6
30	SOUND LOCALIZATION	5	4.2	1.0	0.9
43	GROSS BODY COORDINATION	5	3.5	1.4	2.1
41	GROSS BODY EQUILIBRIUM	5	3.1	1.0	1.0
42	SPEED OF LIMB MOVEMENT	4	4.0	1.9	3.5
51	REACTION TIME	4	3.6	1.4	1.9
40	DYNAMIC FLEXIBILITY	3	4.7	0.9	0.8
38	STAMINA	2	3.0	1.0	1.0
35	EXPLOSIVE STRENGTH	1	5.0	0.0	0.0
37	TRUNK STRENGTH	1	5.0	0.0	0.0
36	DYNAMIC STRENGTH	1	4.0	0.0	0.0

the table, the effect of rater agreement level on number of abilities in the 96H profile can be derived:

- 13 of 13 raters: a profile with 17 abilities
- 12 of 13 raters: a profile with 24 abilities
- 11 of 13 raters: a profile with 29 abilities
- 10 of 13 raters: a profile with 36 abilities

The arbitrary standard in the literature for minimum level of rater agreement usually is a cut-off score of 80% of the raters; that is, abilities will be included in the profile if 80% of the raters pick them.

Field practice varies, partly as a function of number of raters available. For example, if only four raters are available, level of rater agreement can be placed at 100% (if all four must be unanimous for an ability to be include in a profile) or 75% (if three out of four raters is considered sufficient), but the level of rater agreement obviously cannot be 80% or 90% as it could had 10 raters been used. With six raters, the standard can be 83% (five of six) or 67% (four of six) but not in between.

In the case of the pre-test, where there were 13 raters, and if less than unanimous or 100% agreement is acceptable, the level of rater agreement may be 92% (12 of 13), 85% (11 of 13) or 77% (10 of 13). Rater agreement level always affects which abilities and how many abilities make up a given profile.

Table 7 presents the data for MOS 97E. All 13 raters agreed on 12 abilities to be included in the 97E profile. Using 10 of the 13 raters as the cut-off expands the profile to 23 abilities. For 97E, using 10 instead of 13 raters as the cut-off almost doubles the number of abilities in the profile; for 96H it more than doubles the number.

The impact of varying rater agreement levels on both MOSs, using data from the pre-test, is shown in Figure 2. The figure shows the effect of level of rater agreement on how many abilities are judged necessary as well as not necessary. The lower the standard used for the level of rater agreement, the more probable it is that an ability will be categorized either as necessary or as not necessary. The higher the level of rater agreement required, the greater the number of abilities assigned to the area of disagreement will be. For example, as just detailed for 96H, if 100% agreement is demanded, only 17 abilities qualify as necessary. At this level, there is disagreement about the remaining 35 abilities: some raters consider them necessary, and some do not. Dropping the rater agreement level to 92% (12 of 13 raters) makes it easier to reach agreement. With this standard, for example, the profile for 96H expands from 17 to 24 abilities. In addition, with a 92% rater

Table 7

MOS 97E Abilities and Skills--Ordered by "Yes" Responses and Means

	ABILITIES	YES	MEAN	SD	VAR
2	WRITTEN COMPREHENSION	13	6.0	0.4	0.2
1	ORAL COMPREHENSION	13	5.8	0.4	0.2
3	ORAL EXPRESSION	13	5.5	0.8	0.6
31	SPEECH HEARING	13	5.5	0.9	0.8
32	SPEECH CLARITY	13	5.5	0.7	0.5
4	WRITTEN EXPRESSION	13	5.4	0.8	0.6
10	DEDUCTIVE REASONING	13	5.0	0.7	0.5
33	VISUALIZATION	13	4.9	1.5	2.4
6	PROBLEM SENSITIVITY	13	4.7	0.9	0.8
7	ORIGINALITY	13	4.4	0.9	0.9
19	PERCEPTUAL SPD & ACCURACY	13	4.3	1.4	2.0
15	TIME SHARING	13	3.8	1.2	1.5
8	INDUCTIVE REASONING	12	5.1	1.1	1.1
5	MEMORIZATION	12	4.8	1.1	1.1
11	INFORMATION ORDERING	12	4.7	0.9	0.9
14	FLUENCY OF IDEAS	12	4.6	1.2	1.3
18	SELECTIVE ATTENTION	12	4.5	1.3	1.7
9	CATEGORY FLEXIBILITY	12	4.4	1.0	0.9
20	SPATIAL ORIENTATION	12	4.3	1.0	0.9
24	VISUAL COLOR DISCRIMINATION	11	3.0	0.8	0.7
16	FLEXIBILITY OF CLOSURE	10	5.3	0.7	0.5
21	NEAR VISION	10	4.2	1.6	2.7
13	NUMBER FACILITY	10	3.5	1.3	1.7
28	GENERAL HEARING	9	3.8	1.0	0.9
29	AUDITORY ATTENTION	8	4.0	1.1	1.3
12	MATHEMATICAL REASONING	8	3.5	1.2	1.4
17	SPEED OF CLOSURE	7	4.7	1.2	1.6
45	WRIST FINGER SPEED	7	3.9	1.0	1.0
46	FINGER DEXTERITY	7	3.8	0.9	0.8
47	MANUAL DEXTERITY	4	3.1	1.2	1.5
48	ARM HAND STEADINESS	4	2.7	1.1	1.1
44	MULTI-LIMB COORDINATION	3	2.7	0.2	0.1
23	NIGHT VISION	2	4.5	0.5	0.3
25	PERIPHERAL VISION	2	3.8	0.3	0.1
30	SOUND LOCALIZATION	2	3.8	1.3	1.6
39	EXTENT FLEXIBILITY	2	2.5	0.5	0.3
38	STAMINA	1	5.0	0.0	0.0
22	FAR VISION	1	4.0	0.0	0.0
26	DEPTH PERCEPTION	1	2.0	0.0	0.0
27	GLARE SENSITIVITY	1	2.0	0.0	0.0
34	STATIC STRENGTH	0			
35	EXPLOSIVE STRENGTH	0			
36	DYNAMIC STRENGTH	0			
37	TRUNK STRENGTH	0			
40	DYNAMIC FLEXIBILITY	0			
41	GROSS BODY EQUILIBRIUM	0			
42	SPEED OF LIMB MOVEMENT	0			
43	GROSS BODY COORDINATION	0			
49	CONTROL PRECISION	0			
50	RATE CONTROL	0			
51	REACTION TIME	0			
52	CHOICE REACTION	0			

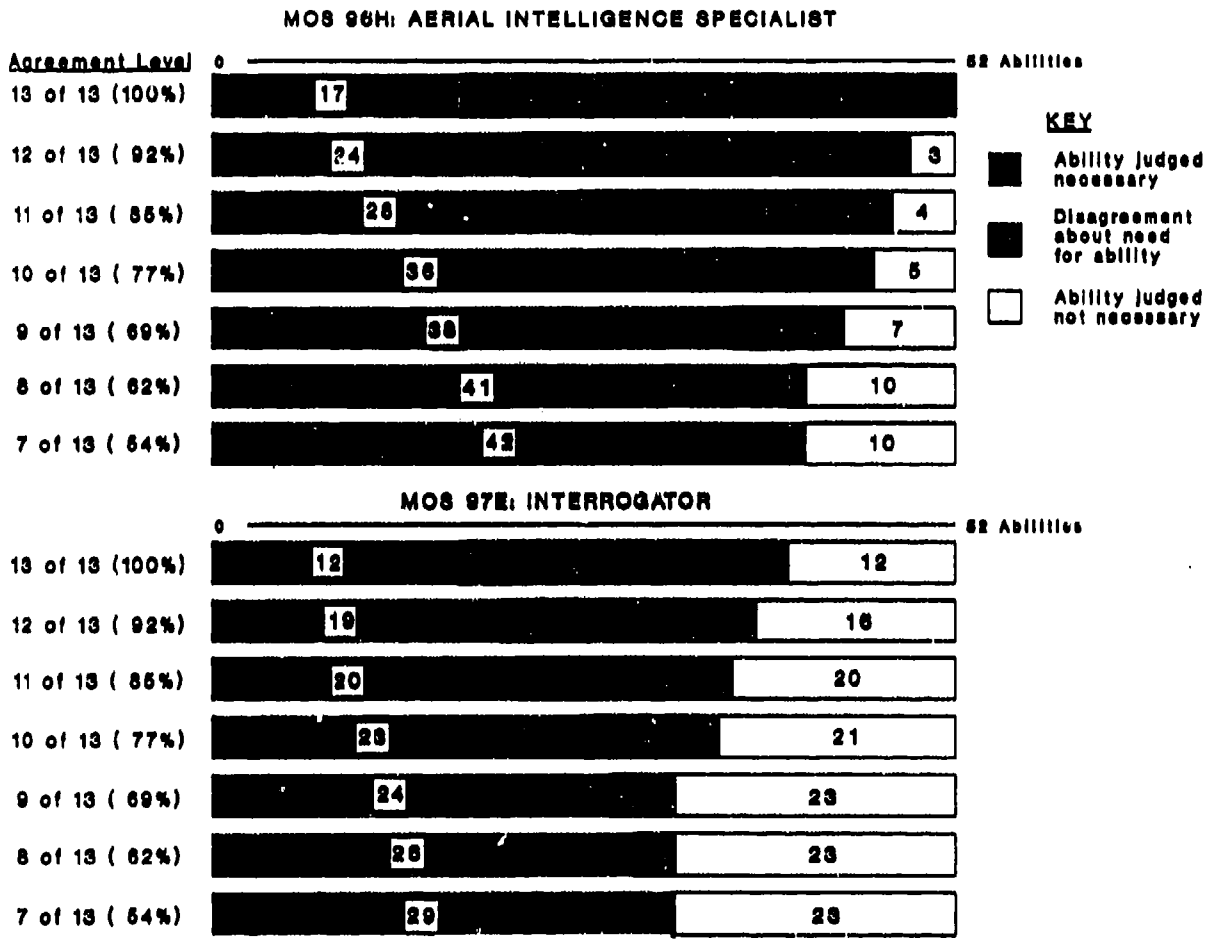


Figure 2. Number of 52 abilities judged necessary and not necessary as a function of rater agreement level.

agreement level, three abilities can be excluded from the profile (i.e., judged unnecessary). At this level, 25 abilities remain in the area of indecision, down substantially from the 35 abilities neither included nor excluded when 100% rater agreement is the standard.

Rather than choosing an arbitrary rater agreement level such as 80%, it may be wiser to look at rater results with respect to the complete impact of their choices in a form similar to that in the figure. Looking at the data in that form may make it easier to determine what the cut-off level should be for various purposes. The nature of the specific abilities included and excluded might also play a part in the judgement.

Table 8 summarizes the proportion of the 52 abilities on which there was agreement among the raters in the pre-test. This table includes agreement on abilities that are not required as well as on those that are. Using data on abilities that are required has a greater effect on the total number of abilities agreed upon for MOS 97E than it does for 96H. The proportion of abilities upon which agreement was reached by these 13 raters is comparable to that reported by Mallamad, Levine, and Fleishman (1980). They used an 80% level of rater agreement as their standard of "agreement," and their raters rated 40 (not 52) abilities. They reported agreement on 28 of the 40 abilities (70%) their raters rated (7 judged required; 21 judged not required) in one case. In other cases they reported, their raters agreed on from 23 (57.5%) to 32 (80%) of the 40 abilities they rated. As Table 8 shows, raters reached agreement on 62% of the 52 abilities for MOS 96H and on 77% of the abilities for MOS 97E if an 85% standard (11 of 13 raters) is used. Thus, agreement in the MI context is comparable to that attained on the Navy, electronics, and civilian tasks used by Mallamad, Levine, and Fleishman (1980).

There is a second source of data that can be used in deciding whether or not an ability should be included in a specific profile. This is the scalar score for each ability generated from Part B of the tool. As both Tables 6 and 7 show, even where there is complete agreement among the 13 raters about the need for a given ability, the average value assigned to a necessary ability by the raters, when asked how much of the ability was needed, varied considerably. In the case of 96H, the scalar means ranged from 5.7 for FAR VISION to 3.5 for FINGER DEXTERITY. It may be wise to establish some minimum scalar score below which an ability is not included in a profile even if all raters judge it necessary. One might assume, for example, that 3.0 would be the minimum acceptable score for inclusion in the ability profile. This kind of decision would say that while the ability is required, it is really not that important for the task or job.

Table 8

Rater Agreement Level and Abilities Required/Not Required

RATER AGREEMENT LEVEL	PROPORTION OF ABILITIES JUDGED AS					
	MOS 96H			MOS 97E		
	REQUIRED	NOT REQUIRED	TOTAL	REQUIRED	NOT REQUIRED	TOTAL
13 OF 13 (100%)	33%	0%	33%	23%	23%	46%
12 OF 13 (92%)	46%	6%	52%	36%	31%	67%
11 OF 13 (85%)	54%	8%	62%	38%	38%	77%
10 OF 13 (77%)	69%	10%	79%	44%	40%	85%

In choosing the minimum scalar value, distribution of the ability in the available population could also be taken into account.

In general, selecting an ability for inclusion in a profile would involve at least two judgements:

ABILITY SELECTED = f(Minimum Number of Raters in Agreement + Minimum Scalar Value)

Thus, two arbitrary and qualitative decisions have to be made. In actual practice, however, most jobs profile nicely, and it becomes reasonably apparent what the critical set of abilities for the job is.

It might be noted, in passing, that the two jobs used as samples in the pre-test are not typical. Each of these jobs is a very rich, complex, and demanding job that requires many abilities. Indeed, the results of using the tool reflect that fact. As Figure 3 shows, data from the 13 raters form distinct and rational profiles for each job, profiles that are appropriate to job demands. In both cases, the demands are heavy and distinctive.

Modifying Anchors

The second part of the assessment process requires a rater to make a scalar estimate from 1 to 7 of how much of an ability, or what skill level, is needed in the job or task being rated. As shown in Appendix B, there is a separate page for scaling each of the abilities. At the top of the page is the name of the ability and its definition. The 1 to 7 scale is in the middle of the page. The anchors used in the pre-test were those from the original MARS development. In that version, three examples were included for each ability. These examples were placed to the right of the scale and were followed by numbers in parentheses that indicated the average scale value that had been assigned to that example by previous judges. A sample from the pre-test version is shown at the top of Figure 4.

There was considerable dissatisfaction with these anchors. Many raters felt they were misleading and that some of the examples were inappropriate to the ability they represented. The examples were intended to serve as anchors and to given some general idea about what the numbers meant in the scale, using a skill example appropriate to the ability but usually not related to the task or job being evaluated. However, the examples appeared to confuse many raters. There is evidence that some raters thought they were to use the numbers from the examples--an unintended transfer.

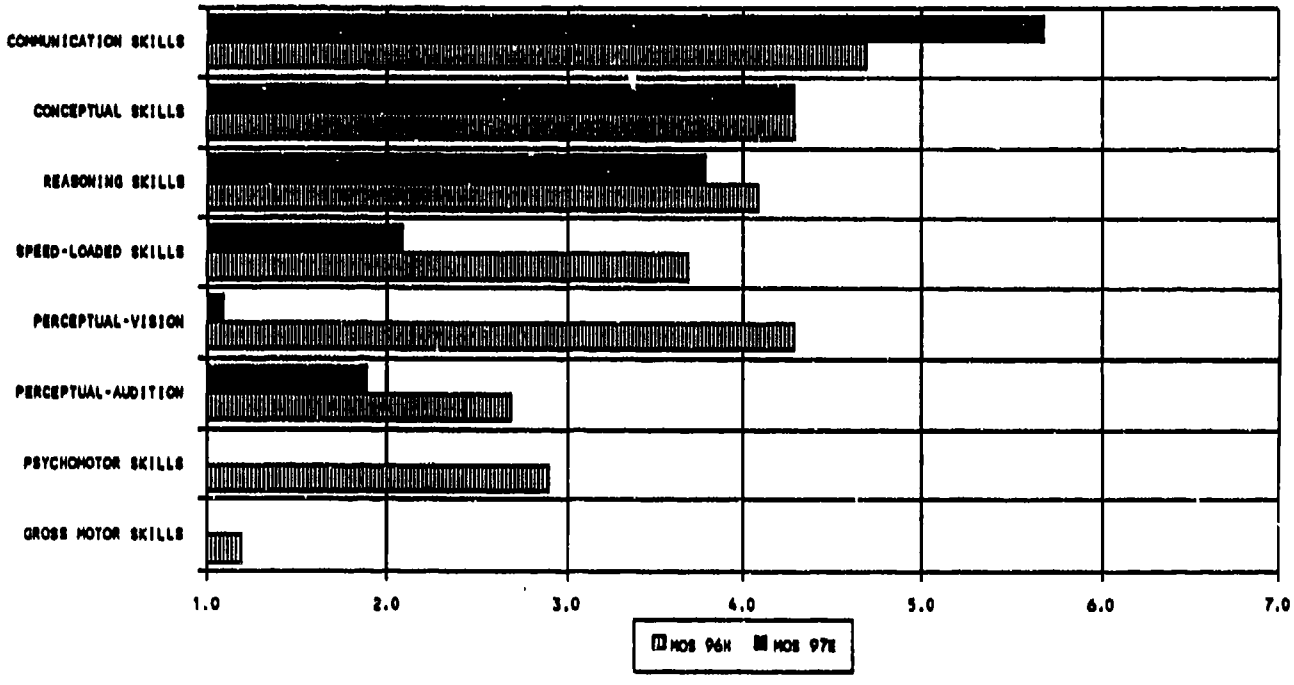


Figure 3. Abilities and skills profiles of two MOSs based on pre-test data (N=13).

49. CONTROL PRECISION: The ability to move controls of a machine or vehicle. This involves the degree to which these controls can be moved quickly and repeatedly to exact positions.

7

6 Drill a tooth (5.96)

5

4 Manipulate farm tractor controls (3.71)

3

2

1 Throw a light switch (1.25)

HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

Example of anchors used in pre-test

1. ORAL COMPREHENSION: The ability to listen to and understand words and sentences.

Understand a lecture on navigating in space

7 A GREAT AMOUNT OF THIS ABILITY IS NEEDED

6

5 QUITE A BIT OF THIS ABILITY IS NEEDED

4

Understand instructions for a sport

3 A MODERATE AMOUNT OF THIS ABILITY IS NEEDED

2

Understand a McDonald's hamburger commercial

1 A MINIMUM AMOUNT OF THIS ABILITY IS NEEDED

HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

Example of modified anchors

Figure 4. Evolution of JCAT, Part B.

A modification was made in the scalar instrument following the feasibility test. Figure 4 also shows the new form of the scalars, illustrated for one ability, ORAL COMPREHENSION. An additional and more conventional set of anchors has been placed to the right of the scale, the examples which had been the only anchors provided in the earlier version have been moved to the left of the scale, and the numbers which used to follow those examples have been dropped. The new anchors to the right of the center scale were selected on the basis of extensive psychometric data published by Bass, Cascio, and O'Connor (1974). Using these data allowed the selection of phrases which represent nearly equal intervals between the anchors shown in the figure.

Selecting Raters

In using a technique in which raters make judgements about a task and its demands on those who perform it, one of the fundamental and practical issues to be faced is what kinds of raters must be used. As mentioned before, must the raters be subject matter experts who are experienced in performing the task they are rating? Can they be, or even should they be, personnel experts or task analysts? Or, given a task description, can a wide variety of individuals, with varying backgrounds and experiences, carry out the translation of job or task requirements into the abilities and skills needed for those jobs and tasks?

Earlier research (Fleishman & Mumford, 1989; Fleishman & Quaintance, 1984; Mallamad, Levine, & Fleishman, 1980) suggests that the use of highly trained job experts may not be necessary when decision flow diagrams are used to structure judgements. If it were necessary to use SMEs, criteria would have to be established about what constitutes a SME and demands placed on highly trained personnel who would be available only on a restricted basis for assessment procedures. Being able to use more heterogeneous populations of raters eases limitations on when, where, and how the assessment can be accomplished.

The pre-test conducted with both flow diagrams and scalars provided an opportunity to examine responses made by raters from a variety of backgrounds. As explained earlier in this report, raters included Army personnel, ARI staff members, and contractor personnel. The question arises, what differences, if any, existed in judgement patterns as a function of experience or background?

One way to answer this question is to look at the degree to which raters agree in their judgements. Correlation techniques are probably the most conventional way to express agreement numerically. For example, Mallamad, Levine, and Fleishman (1980)

reported interclass correlation coefficients for agreement between two groups of five judges rating five different tasks ranging from 0.76 to 0.85. Because such measures look at overall agreement, they provide no insight into the degree to which there may be agreement on some subset of abilities. Mallamad, Levine, and Fleishman (1980) developed a measure based on the proportion of raters selecting a particular ability that allowed them to look at the proportions of abilities on which there was a high level of agreement. This metric is useful in looking at what agreement there is about which abilities are to be included in a profile of a job or task but does not indicate if there are differences among different kinds of raters.

As a way of determining whether or not there were differences among raters as a function of their backgrounds, a measure of dissent was developed. Responses were categorized as dissenting or agreeing with majority rater responses. Then dissents were examined as a function of rater background to discover whether or not background, experience, or training of various kinds was associated with a disproportionate level of dissent.

To obtain the measure of dissent, "agreement" was arbitrarily established as meaning that at least 10 out of 13 raters judged that an ability was needed for an MOS. Thus, when all 13 raters selected an ability (as was the case for 17 abilities when MOS 96H was rated and for 12 abilities when 97E was rated), there were no dissents. When 12 of the raters selected an ability, there was one dissent. If 11 raters selected an ability, 2 dissented; if 10, 3 dissented. The agreements and dissents are tabulated for each MOS by agreement level in Table 9.

With respect to judgements on 96H, if an agreement level of 10 of 13 raters (77%) is used, the raters will have agreed that 36 of the 52 abilities are needed. The 36 abilities will have received 429 of a possible 468 "yes" votes. There would have been 39 dissenting judgements or dissents to that choice of abilities. For 97E, with the same rater agreement level (10 of 13), the majority of raters will have agreed that 23 of the 52 abilities are needed. Those 23 abilities will have received 281 of a possible 299 votes, with 18 dissents.

Table 10 shows how the dissents distribute as a function of rater background. Army personnel made up 31% of the raters. On 96H they accounted for only 21% of the dissents, but on 97E they accounted for 50%. In contrast, ARI personnel, 23% of the raters, had 38% of the dissents on 96H but only 22% of those on 97E. Agency affiliation seems to interact with MOS judgements. There is a high proportion of dissents attributable to Army personnel when rating 97E and a low proportion when rating 96H.

Table 9

Agreement and Dissent by MOS and Rater Agreement Level

RATER AGREEMENT LEVEL	MOS 96H		MOS 96E	
	AGREEMENTS	DISSENTS	AGREEMENTS	DISSENTS
13 OF 13	271	0	156	0
12 OF 13	84	7	84	7
11 OF 13	44	8	11	2
10 OF 13	80	24	30	9
TOTAL NUMBER	429	39	281	18
PERCENTAGE	92%	8%	94%	6%

Table 10

Dissents from Majority Ratings as a Function of Rater Background

RATER BACKGROUND	96H		97E	
	% RATERS	% DISSENTS	% RATERS	% DISSENTS
ARMY	31%	21%	31%	50%
ARI	23	38	23	22
CONTRACTOR	46	41	46	28
MI: SME	15	10	15	28
MI: TRAINING R&D	46	51	46	33
NON MI	38	38	38	39
PSYCHOLOGISTS	54	62	54	33
NON-PSYCHOLOGISTS	46	38	46	67
MALE	62	46	62	67
FEMALE	38	54	38	33

MI SMEs show a pattern similar to that of the Army personnel, which is not surprising considering the overlap in their membership. It is nevertheless puzzling why these SMEs account for few of the dissents on 96H and for a disproportionately high number on 97E. Evidently, the picture these SMEs have of MOS 96H reflects some general consensus, one shared with the rest of the raters, whereas their picture of MOS 97E is not as consistent with that of the other raters.

Since dissents represent a judgement that an ability is not necessary for a particular job, the data suggest that Army personnel and MI: SMEs feel that some abilities included in the profile for 97E by the majority of raters could be omitted. An inspection of the data shows that different individuals dissent on different abilities. One Army rater would leave out FLUENCY OF IDEAS and FLEXIBILITY OF CLOSURE, while another Army rater would omit INFORMATION ORDERING and NUMBER FACILITY. The only sense in which these special categories of raters may be said to be different is that they would choose a slightly more restricted list of abilities as necessary for 97E.

In summary, within the pre-test panel of 13 raters, being male, non-psychologist, MI: SME, and Army was associated with low levels of dissent on 96H and higher levels of dissent on 97E. Regardless of what this says about experience and imagination, it is important to remember the high level of agreement on profiles for these two MOSs. The profile for 96H contained 36 abilities, if 10 of 13 raters is used as the standard for agreement. The 39 dissents on this profile represent only 8% of the judgements made about these abilities for this MOS. For 97E, the 18 dissents represent only 6% of the judgements. Thus, for both MOSs there is a very high level (above 90%) of support for the abilities chosen. There is a great deal of agreement about what abilities are important for specific MOS, there is a clear distinction between the MOSs in terms of abilities selected, and the picture that emerges of the MOSs is much the same regardless of the background of the raters.

These data support the hypothesis that, using this tool, highly job-trained SMEs are not necessarily required for reliable and valid judgements of the jobs and tasks being assessed. This could on the one hand reduce manpower pressure to obtain SME raters and on the other hand could allow for greater numbers of raters where there are few appropriate and available SMEs. In short, the technique may be robust with respect to rater background and experience. But, just how much relevant background and experience are required, and of what kind, remains to be explored.

Categorizing Intelligence Tasks

The instrument being used and developed here can be applied either from the job/task standpoint or from the aspect of personnel characteristics. As a part of job analyses, attempts have been made to tie the analysis to the jobs and tasks of immediate interest--in the present case, military intelligence.

One step in this process, therefore, was to evaluate two MI MOSs in a feasibility test and (in data to be presented later in this report) to expand the evaluation to all seven MOSs of the 96 Career Management Field.

An amplification of this approach is to view the military intelligence process as consisting of eight intelligence production activities:

1. Planning
2. Setting-up or preparing
3. Collecting data
4. Managing or cataloging data
5. Analyzing or exploiting data
6. Interpreting data
7. Preparing outputs
8. Disseminating information.

This is a taxonomy of intelligence activities, and it implies that any MI job or MOS could potentially require these activities. As will be seen later, it does not mean that every MOS must do all eight activities. Indeed, as will be seen, the MOSs will vary in which activities are most important.

The MOSs will also vary in the abilities and skills that underlie performance of the eight activities. Data on these variations will also be presented in a later chapter. A general taxonomic class does not necessarily imply a fixed abilities and skill set across all job settings. For example, there are many ways of "collecting data" and "disseminating information," and as those ways differ so will the abilities and skills associated with them.

From another viewpoint, the eight activities are of general interest since they could be used in many different types of jobs beyond the world of military intelligence. The taxonomic class words--"planning," "interpreting data"--express activities that are widely discussed at broad and sometimes vague levels of discourse. It should be interesting and perhaps important, therefore, to see what the activities translate into in a specific set of jobs (seven MI MOSs) through the transform of ability and skill assessment.

To test these possibilities, a method had to be invented which would allow SMEs to make abilities and skills judgements relative to the eight intelligence production activities. The procedure required that each rater use the abilities selected in JCAT Parts A and B and then show where they would be used in the eight activities. In addition, a quantitative judgement was required (on the 1 to 7 scale) of the relative importance of the ability for the activity. This became Part C.

One purpose here is to attempt to tie abilities and skills more directly to specific military intelligence activities. Data on this connection will be shown and discussed later in the report.

Matching Profiles

A major output of this technique is abilities and skills profiles. Whether one looks at systems, jobs, tasks, or people, the basic data will be a set of 50 abilities values, either indicating the presence or absence of the ability and/or some measure of the importance of that ability. A major step will the be to compare and match a variety of profiles:

- Two or more different systems
- Two or more different jobs
- Two or more different tasks
- A profile of system demands and a profile of personnel capability
- Two or more different groups of people.

Many other possible comparisons could be made. Whatever the match, once two or more profiles have been generated, the question immediately arises as to specifically how the profiles can be compared. The answer depends upon at least two factors: what kinds of information are needed and whether qualitative or quantitative answers are required.

A partial example of a qualitative set of answers has already been given in a previous report (Muckler, Seven, & Akman, 1990b) in comparing the profiles of a hypothetical unmanned aerial vehicle (UAV) and MOS 96H, as shown in Figure 5. Suppose that the context is system design and the profile comparison has been generated with the current state of UAV system design and what is known about the capabilities of MOS 96H. Here the question is not so much "Can a qualified MOS 96H perform the

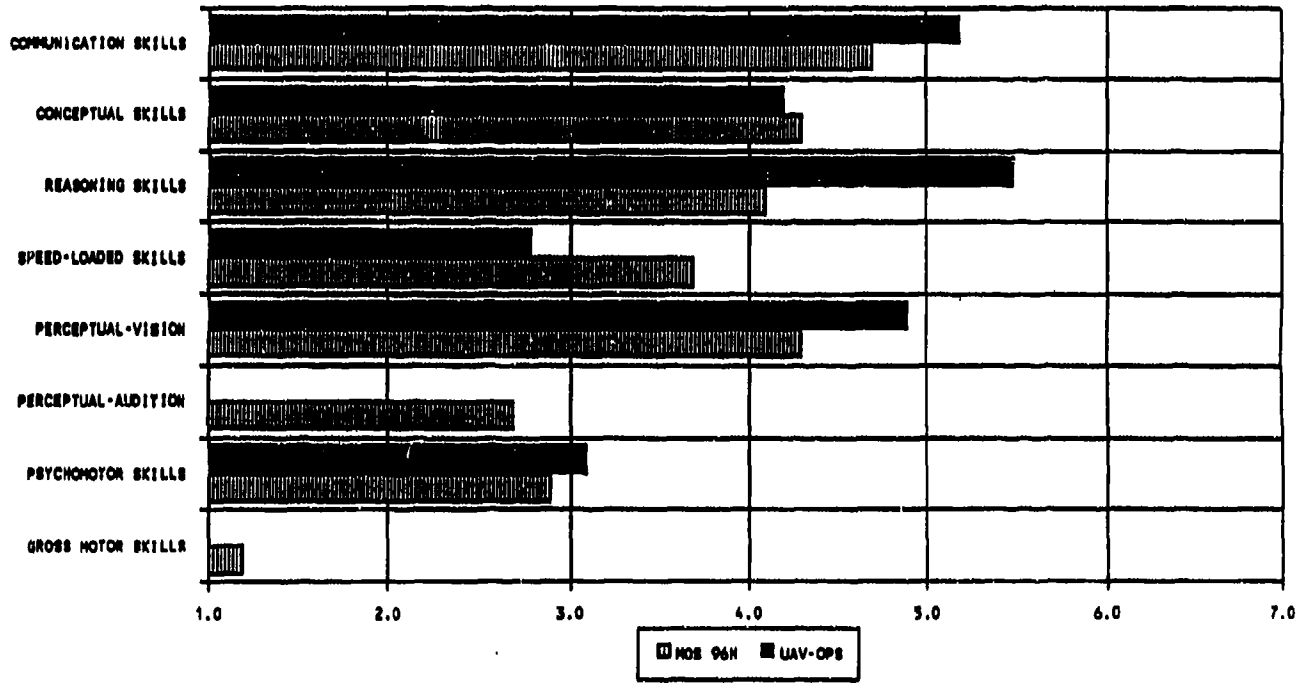


Figure 5. A comparison of UAV operations with MOS 96H.

job?" as it is "Where in the design may there be troubles or problems if MOS 96H is used to perform the job?" For example, there may be problems because the design generates tasks that place too high demands in the areas of Reasoning Abilities and Perceptual (Vision) Abilities. In system design, this is useful diagnostic information that enables human engineering to look closely at the design, to see where these problems have been created, and to re-design the problems away or at least reduce them. The tool has been used precisely in this way in the design of the Howitzer Improvement Program (HIP) and several new air defense systems. Human engineering design improvements were made on the basis of the diagnostic data before design freeze.

Further, Fleishman and Mumford (1989) have suggested in detail that these individual differences data point to areas of concern for training. If, for example, the design cannot reduce the performance demands in a given area, then the search for compensation by training must begin. The results may suggest areas where current training is either satisfactory or unsatisfactory and where the new system may, or may not, need reconsideration for personnel training.

A different way of approaching the profile matching and comparison problem is in terms of a quantitative comparison between profiles. Technically, this topic has been of major concern for decades to certain areas of psychology where information is generated in terms of profiles (such as the Semantic Differential and the Minnesota Multiphasic Personality Inventory). The technical question is, can a quantitative score be generated from the profiles that will express the differences between the profiles?

The first systematic attempt at defining such quantitative measures came from Cronbach and Gleser (1953) in terms of a general expression of the distance between profiles:

$$D_{12}^2 = \sum_{j=1}^{k} (x_{j1} - x_{j2})^2$$

where: D = the distance measure between two profiles
x_{j1} = distribution of profile scores on one variate
x_{j2} = distribution of profile scores on a second variate

D^2 is a "general expression for the dissimilarity between two profiles" or "a measure of similarity." Cronbach and Gleser (1953) showed that the profile matching formulae to that date, including correlation coefficients, were variations of this general equation with widely varying relative advantages and disadvantages.

Since the classic Cronbach and Gleser (1953) report, there has been a large literature proposing variations on D^2, other measures of profile similarity, or the use of some other form of composite criteria. At least four basic lessons appear to have come from the literature as evidenced, for example, from the comparative evaluations of Pralicx and Raju (1982) and Sparrow (1989):

1. Many computational expressions of profile similarity give about the same results.

2. Simple measures appear to be about as good as complex measures.

3. Some complex measures, and particularly elaborately weighted variable sets, may have very wrong implications.

4. "Profile similarity" is not a single dimension, and it may always reflect different aspects of profile comparisons (Cohen, 1978).

But perhaps the most difficult problem in a profile similarity measure, or any composite score, is, what does the number hide or obscure? What information is lost by calculating a single number purporting to express the degree of similarity between two profiles, for example? In profile data of the type described here, the loss may be significant if application and interpretation rely solely on a similarity score. What this suggests is that one should not depend upon a single score when a richness of information can be found in the basic abilities profile data and their associated clusters.

Related to that problem is the difficulty of interpreting a profile similarity score. Consider, as an example, three D^2 scores from Cronbach and Gleser (1953, p. 460):

$$D_{AB}^2 = 20$$

$$D_{AC}^2 = 63$$

$$D_{BC}^2 = 63$$

What do the numbers "20" and "63" mean; what kind of a scale is this; or, how does one interpret the D^2 scale number? To provide a common and understood interpretive framework, many attempts (cf., Cattell, 1949; Cohen, 1969) have been made to express profile similarity through correlation coefficients thus putting profile similarity in the range of +1 to -1, but this has raised a number of difficult technical problems. (For example, what is the meaning of a zero correlation between two profiles?)

To the knowledge of the present writers, no quantitative measures of profile matches or comparisons have been devised or published for, or ever used on, the types of ability and skills profiles highlighted here. The data collected here may provide a basis for future attempts to invent and evaluate measures of profile similarity.

Applying the MARS Method

Although the MARS technique has been in practical use in some form for at least 20 years, it has been expanded and changed considerably over that period. Indeed, most practitioners (including the present ones) have seen fit to adapt the MARS tools in varying degrees to their particular application problem.

One such change was the expansion of the basic abilities and skills set to 52 which has been currently reduced to 50 (Fleishman & Mumford, 1989). Another change has been a move away from the flow diagram technique (JCAT, Part A) to a sole dependence upon the scaling method (JCAT, Part B). This change has happened despite data (Mallamad, Levine, & Fleishman, 1980) that the two together give better (i.e., more reliable and more focused) estimates of required abilities. In this application, both tools have been retained despite a possible cost in rater time.

Recently, Fleishman and Mumford (1989, pp. 218-219) have clarified the procedure for using MARS at the task level. The first three steps involve developing a critical task inventory, assisted and reviewed by SMEs, so that only the most critical tasks in a job will be evaluated. The analysis in the present application has been at the job level, although using JCAT, Part C is a way of getting military intelligence tasks more specifically.

The fourth step is to apply the MARS method at the task level using a second panel of SMEs. Two immediate problems arise here with respect to the use of a panel:

1. Fleishman and Mumford (1989, p. 217) recommend 15 to 20 SMEs as ability and skill raters. Unfortunately, in practice, there are often not that many available, as may be seen in the next chapter with respect to 96 CMF where a maximum of 10 SMEs could be gotten for an MOS. In the context of new system design and analysis of abilities demands, there may be only a handful of individuals who understand the system. This limitation is always true in early system test and almost always true even in early operational test and evaluation. The methodological need is to develop some guidelines as to what constitutes a minimum rater sample that will produce consistent and reliable results.

2. In fact, the method may not need, in a strict sense, "SMEs," a subject which was discussed in a previous section, Raters could be "... job incumbents, job analysts, supervisors, or trainers" (Fleishman & Mumford, 1989, p. 217). The method does appear to be robust across different kinds of raters without the need for the strict rater criterion of SME. But this subject also needs more methodological investigation.

Finally, the applications of the MARS method and its variations over the past 20 years suggest that it is both robust and useful in a wide variety of human job contexts. The method should continue to be used and to undergo improvement and adaptation.

A Test Application to 96 CMF

Administration of the JCAT Test Battery

In May 1990, a JCAT test battery was prepared and given by the ARI field staff to 65 Military Intelligence subject matter experts (SMEs) at Fort Huachuca, Arizona. These experts were members of 96 CMF and the seven MOSs that currently constitute 96 CMF. All of the material to be presented in the rest of this report will pertain to the administration of the JCAT test materials and the results that were obtained from that administration.

Three Parts of MI JCAT

JCAT consists of three major parts. In the first part, the raters determine the need or lack of need for 50 abilities relative to a particular job. The second part is used by the raters to estimate how much of an ability is required. The third part is used by raters to determine how much of the ability is required for performing specific intelligence functions. For ease of reference, the three JCAT steps have been identified as Part A, Part B, and Part C, respectively.

Part A: Decision Flow Diagrams. Figure 6 shows the first page of the binary flow diagrams used in JCAT by raters to determine if a particular ability is required to perform a particular job. The questionnaire may be used in conjunction with a task description pertaining to the job being rated and an answer sheet in which the rater is told to circle the abilities which are required.

For ease of use, a standard set of symbols has been used to guide the rater through the process. Triangles indicate instructions, directing the flow through the charts. Rectangles indicate questions about the job; the questions have been carefully designed to elicit "YES" or "NO" responses about the job being rated. Ellipses contain the name of an ability or skill and a number referring to the order in which the ability or skill is listed in the answer form.

If the rater reaches an ellipse through the decision flow process, the ability contained therein has been judged as required to perform the job being rated. A determination must be made for each of the 50 abilities included in JCAT. Appendix A contains a complete set of the decision flow diagrams.

Part B: Scaling the Abilities. Figure 7 shows the scaling guide for one of the 50 abilities included in JCAT. There are three key parts to the scale. First, each sheet includes the definition of the ability being rated. Second, on the left hand side of the seven point scale are high, low, and mid level

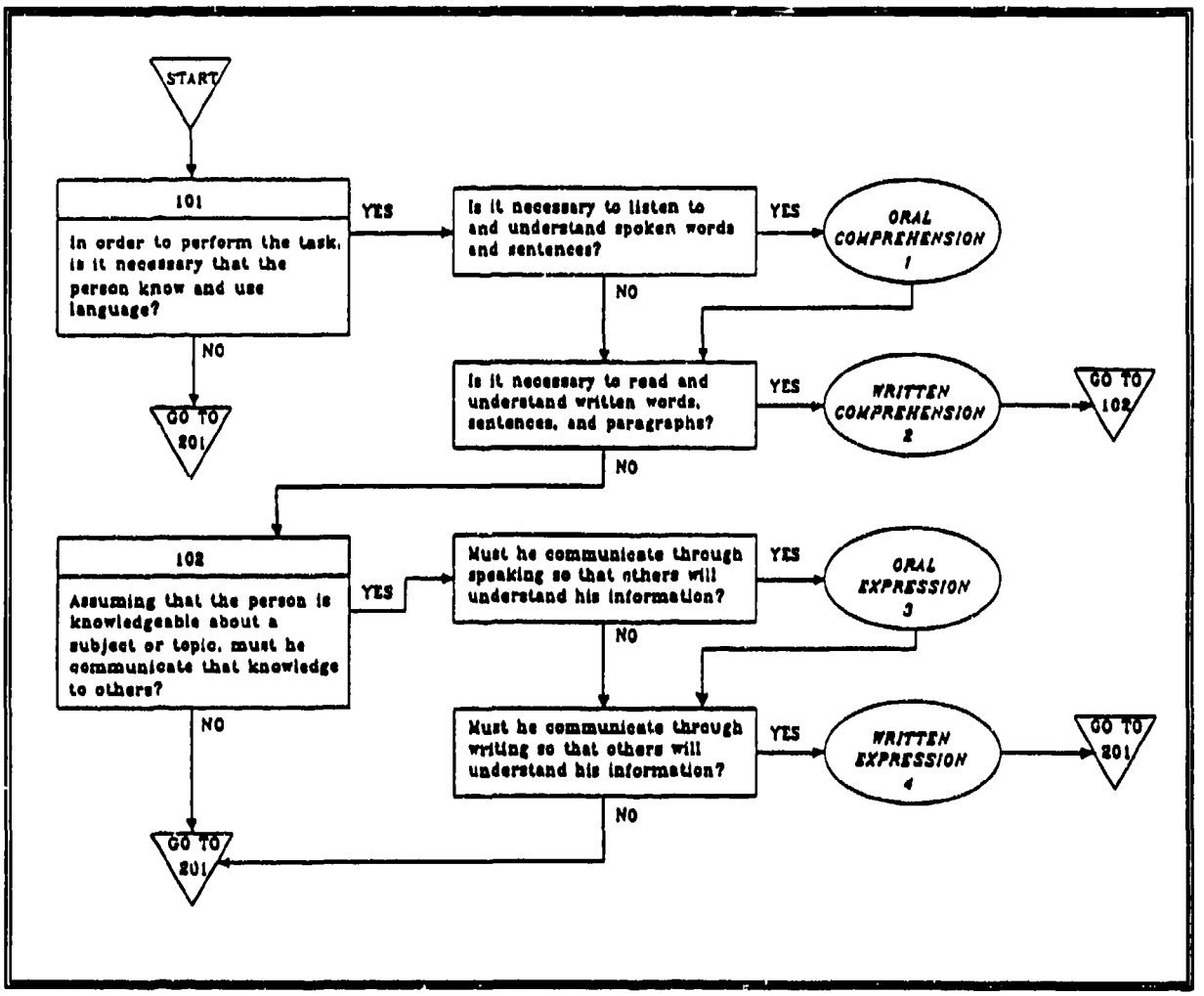


Figure 6. JCAT Part A decision flow diagrams.

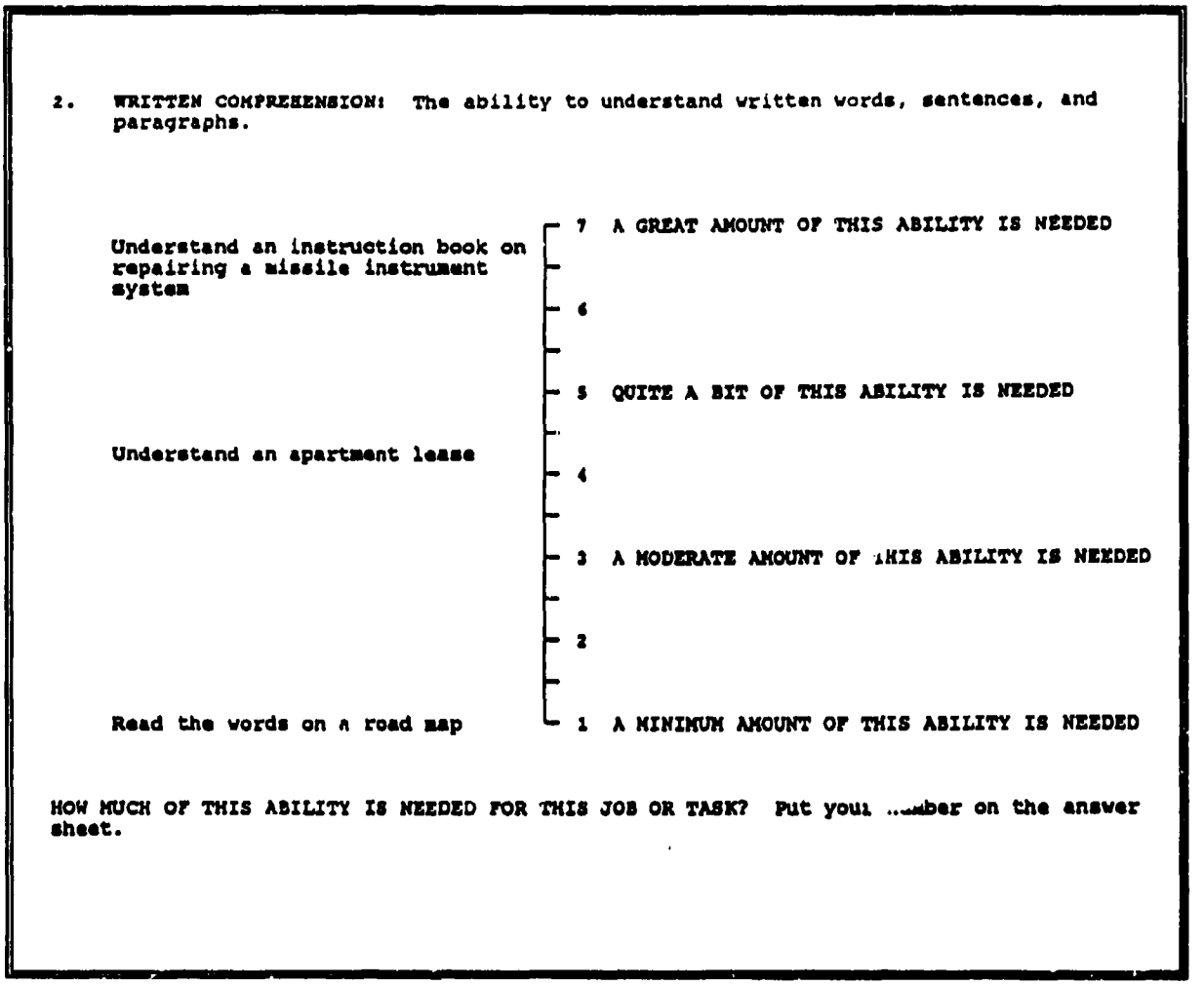


Figure 7. Example of JCAT Part B scaling guide.

anchors based on sample tasks which the rater can use for guidance in rating the task being analyzed. On the right hand side is an alternate set of anchors based on judgements reflecting "great amount", "quite a bit", "moderate", and "minimum amount" of the skill. Appendix B presents the complete set of scalars for the JCAT abilities.

For each ability selected in Part A, the rater is asked to use the Part B guide to develop a rating between 1 and 7 representing how much of the ability or skill is required. The answer is recorded on the same answer sheet used for Part A in spaces adjacent to the circled abilities (Figure 8).

Part C: Application to Intelligence Production Activities. While Part A and Part B have application in a variety of job performance settings, Part C has been tailored to elicit information specific to military intelligence. This third part is based on a task taxonomy for MI work. Table 11 lists eight "intelligence production activities".

The rater is asked to indicate how much of the abilities selected in Part A are required in each of the eight production activities. Wherever there is a requirement, the rater uses a seven point scale similar to that used in Part B to make an estimate (Figure 9). The Part C answer sheets are contained in Appendix C.

Procedure

Subjects were provided the materials and oral instructions either individually or in groups. The instruction periods lasted about 10 minutes. In that period the project was briefly described, and the three tasks required were described. The location within the materials was shown for each task, the answer sheets identified, and an explanation was given on how the tasks were to be done and the answer sheets completed. It was also pointed out that there were directions in the instruction booklet and a practice exercise that they could do if they wanted experience with the first t asks. In addition, the position descriptions were pointed out, but since they had not been verified by the school, subjects were told to complete the tasks based on their experience performing their MOS.

Twelve subjects were not available to attend the instructional briefings. For these subjects, an officer-in-charge was given the materials and the directions, and was asked to hand out the materials and provide instructions to these subjects.

96 CMF ANSWER SHEET

Use this answer form for Parts A and B of the JCAT procedure

PART A: SELECTING ABILITIES. Circle the number of each ability needed for the job.

PART B: ESTIMATING AMOUNTS. In the blank after each circled ability, write your number estimate of how much is needed.

1. Oral Comprehension ____
2. Written Comprehension ____
3. Oral Expression ____
4. Written Expression ____
5. Memorization ____
6. Problem Sensitivity ____
7. Originality ____
8. Fluency of Ideas ____
9. Flexibility of Closure ____
10. Selective Attention ____
11. Spatial Orientation ____
12. Visualization ____
13. Inductive Reasoning ____
14. Category Flexibility ____
15. Deductive Reasoning ____
16. Information Ordering ____
17. Mathematical Reasoning ____
18. Number Facility ____
19. Time Sharing ____
20. Speed of Closure ____
21. Perceptual Speed and Accuracy ____
22. Reaction Time ____
23. Choice Reaction Time ____
24. Near Vision ____
25. Far Vision ____
26. Night Vision ____
27. Visual Color Discrimination ____
28. Peripheral Vision ____
29. Depth Perception ____
30. Glare Sensitivity ____
31. General Hearing ____
32. Auditory Attention ____
33. Sound Localization ____
34. Control Precision ____
35. Rate Control ____
36. Wrist-Finger Speed ____
37. Finger Dexterity ____
38. Manual Dexterity ____
39. Arm-Hand Steadiness ____
40. Multi-Limb Coordination ____
41. Extent Flexibility ____
42. Dynamic Flexibility ____
43. Speed of Limb Movement ____
44. Gross Body Equilibrium ____
45. Gross Body Coordination ____
46. Static Strength ____
47. Explosive Strength ____
48. Dynamic Strength ____
49. Trunk Strength ____
50. Stamina ____

Figure 8. JCAT Part A and B answer sheet.

Table 11

Intelligence Production Activities

Planning: Any intelligence processing activity or group of activities which involves preparing in advance how you intend to accomplish a task or job function. For example, outlining a set of questions to ask a subject, determining how equipment must be deployed, determining the frequencies to collect on.

Setting-Up or Preparing: Any intelligence processing activity or group of activities which must be accomplished before a mission related task can be carried out. For example, deploying equipment, calibrating equipment, collecting information from a data base, preparing a map overlay.

Collecting Data: Any intelligence processing activity or group of activities which must be carried out in the collection of data which will later be processed or analyzed by you or someone else. For example, interrogating a subject, listening to and recording voice communications, watching signals on a scope, operating collection equipment.

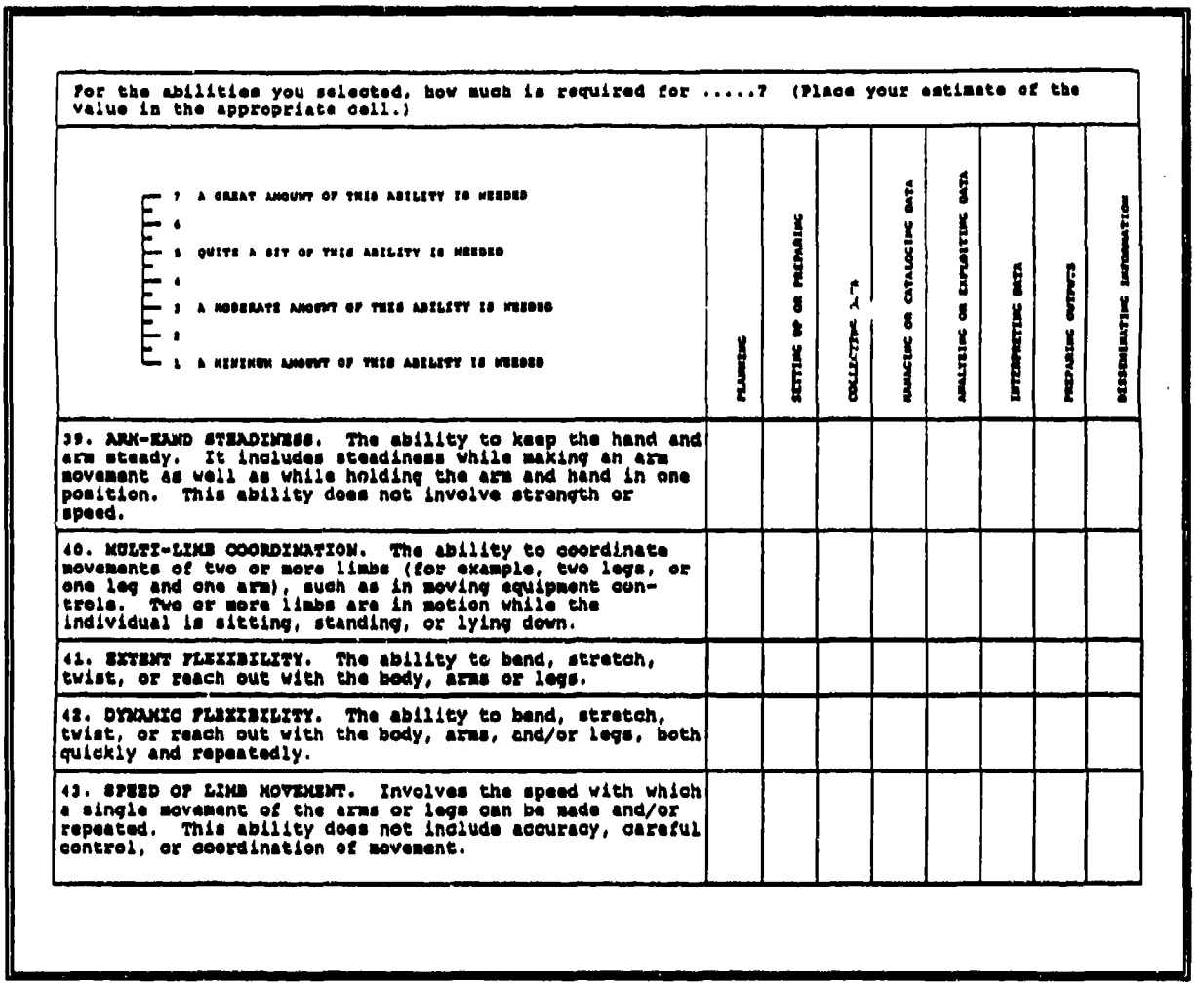
Managing or Cataloging Data: Any intelligence processing activity or group of activities which prepares the collected data for later processing or analysis. For example, using a computer terminal to input data, logging the receipt of a spot report in a journal, placing incoming information on a sitmap.

Analysing or Exploiting Data: Any intelligence processing activity or group of activities which requires the processing of collected data or information; to combine it into a higher level of information or to determine the relationships between various types of information. For example, doing intelligence preparation of the battlefield, providing input to an intelligence estimate.

Interpreting Data: Any intelligence processing activity or group of activities which result in a prediction from or an explanation of a body of previously analyzed data. For example, deriving possible avenues of approach, developing alternative deception strategies, figuring out why the enemy has made an unusual move.

Preparing Outputs: Any intelligence processing activity or group of activities which requires data or information to be placed in a format. For example, making briefing charts, putting data in message format, encrypting.

Disseminating Information: Any intelligence processing activity or group of activities which result in the transmission of information or data from one source to another. For example, sending a message by morse code, delivering a briefing, talking on the radio or telephone.



For the abilities you selected, how much is required for .....? (Place your estimate of the value in the appropriate cell.)

7 A GREAT AMOUNT OF THIS ABILITY IS NEEDED
6
5 QUITE A BIT OF THIS ABILITY IS NEEDED
4
3 A MODERATE AMOUNT OF THIS ABILITY IS NEEDED
2
1 A MINIMUM AMOUNT OF THIS ABILITY IS NEEDED

	PLANNING	SETTING UP OR PREPARING	COLLECTING DATA	MANAGING OR CATALOGING DATA	ANALYZING OR EXPLOITING DATA	INTERPRETING DATA	PREPARING OUTPUTS	DISSEMINATING INFORMATION
39. ARM-HAND STEADINESS. The ability to keep the hand and arm steady. It includes steadiness while making an arm movement as well as while holding the arm and hand in one position. This ability does not involve strength or speed.								
40. MULTI-LIMB COORDINATION. The ability to coordinate movements of two or more limbs (for example, two legs, or one leg and one arm), such as in moving equipment controls. Two or more limbs are in motion while the individual is sitting, standing, or lying down.								
41. EXTENT FLEXIBILITY. The ability to bend, stretch, twist, or reach out with the body, arms or legs.								
42. DYNAMIC FLEXIBILITY. The ability to bend, stretch, twist, or reach out with the body, arms, and/or legs, both quickly and repeatedly.								
43. SPEED OF LIMB MOVEMENT. Involves the speed with which a single movement of the arms or legs can be made and/or repeated. This ability does not include accuracy, careful control, or coordination of movement.								

Figure 9. Example of JCAT Part C answer sheet.

Test Materials

The test materials were based on the three parts of the JCAT. The entire test materials included

1. A fact sheet briefly describing the project,

2. An Instruction Booklet containing instructions for completing each of the three required tasks, job descriptions for each of the 96 CMF MOSs, the flow diagram technique for identifying abilities and skills, the seven-point scales for each ability, definitions for the eight intelligence processing activities, a practice exercise, and

3. An Answer Booklet containing a rater information sheet, MOS ability and skill answer form, and answer forms for the ability and skill levels for the intelligence processing activities.

Subjects

The subjects were provided by the U.S. Army. They ranged in grade from Specialist 4 to Sergeant Major. The final sample is shown in Table 12. The minimum subject experience requirement was one field assignment in the MOS. All subjects equalled or exceeded that requirement.

Since a rater information sheet was provided for each subject about MOS background and experience (Figure 10), more detailed information is available on rater characteristics.

Table 13 gives relevant background and experience data on each of the 65 raters from this study. These data include current grade, years in the Army, years in the current MOS, number of MOS field assignments, and the number of military intelligence courses each rater had. Visual examination of the data should suggest that these were very highly experienced MI specialists in each of their specialties.

Another way of looking at background and experience of the raters is shown in Table 14 which contains some summary statistics about background and experience by MOS. The average grade of the 65 raters was E-6. They have been in the U.S. Army for an average of approximately 12 years; all had at least one field assignment in the MOS, and on an approximate average they will have had three field assignments and two MI training courses.

Table 12

Subject Sample for 96 CMF Test

Total	MOS
9	96B: Intelligence Analyst
10	96D: Imagery Analyst
8	96H: Aerial Intelligence Specialist
9	96R: Ground Surveillance System Operator
10	96B: Counter Intelligence Agent
10	97E: Interrogator
9	97G: Counter-Signals Intelligence Specialist
65	96 CMF: Military Intelligence

RATER INFORMATION

Your responses on the MOS assessment are anonymous. However, we need some information on your U.S. Army background and experience.

Month/Year Entered U.S. Army _____ Current MOS _____ Current Grade _____ Month/Year Acquired MOS _____

Additional Skill Identifiers: 1. _____ 3. _____

2. _____ 4. _____

Field Assignments in Relevant MOS:

	TYPE	DURATION From (M/Y) To (M/Y)
1.		
2.		
3.		
4.		

Other Military Intelligence MOSs Held: MOS _____ When Held (From/To) _____

MOS _____ When Held (From/To) _____

Military Intelligence Training Courses Completed:

NUMBER/TITLE	LENGTH (Weeks)

Figure 10. JCAT rater information sheet.

Table 13

Rater MI Background and Experience

MOS	GRADE	YRS ARMY	YRS MOS	# MOS FIELD ASSIGNMENTS	# MI TRNG COURSES
96B	E-6	15	5	1	2
96B	E-6	11	11	4	3
96B	E-5	11	7	2	3
96B	E-6	15	7	4	2
96B	E-6	7	6	2	1
96B	E-7	13	10	4	1
96B	E-5	10	9	4	4
96B	E-5	7	6	4	1
96B	E-9	22	21	4	4
96D	E-7	15	14	4	4
96D	E-4	3	3	1	3
96D	E-6	6	3	2	0
96D	E-3	4	4	1	4
96D	E-7	13	12	5	5
96D	E-5	6	6	4	2
96D	E-5	6	3	1	2
96D	E-8	17	16	4	2
96D	E-6	8	4	3	6
96D	E-5	7	6	3	3
96H	E-6	10	6	1	3
96H	E-7	11	6	2	3
96H	E-7	14	13	4	2
96H	E-7	14	11	4	2
96H	E-6	11	5	3	0
96H	E-6	11	6	2	2
96H	E-5	8	4	2	1
96H	E-7	21	20	4	1
96R	E-7	6	6	2	0
96R	E-7	19	15	4	2
96R	E-7	21	12	3	3
96R	E-5	7	7	3	1
96R	E-6	17	13	4	1
96R	E-7	13	13	3	1
96R	E-6	14	14	4	4
96R	E-7	18	14	4	1
96R	E-6	15	15	2	4
97B	E-6	7	3	1	2
97B	E-7	13	8	3	1
97B	E-7	13	5	3	4
97B	E-6	8	4	2	3
97B	E-6	9	9	3	3
97B	E-7	16	10	4	2
97B	E-7	10	4	2	1
97B	E-7	17	5	2	1
97B	E-6	12	5	4	1
97B	E-5	3	3	1	2
97E	E-6	11	5	2	1
97E	E-5	6	5	3	1
97E	E-5	7	7	3	4
97E	E-7	17	13	4	3
97E	E-7	14	13	3	3
97E	E-6	13	5	3	3
97E	E-7	15	13	4	4
97E	E-6	7	5	1	1
97E	E-6	9	7	4	3
97E	E-5	5	4	2	0
97G	E-7	19	18	4	3
97G	E-6	12	9	3	2
97G	E-6	12	8	1	3
97G	E-6	12	8	3	2
97G	E-7	20	20	4	2
97G	E-6	17	16	4	1
97G	E-7	18	17	4	1
97G	E-5	10	10	4	2
97G	E-7	15	14	4	2

Table 14

Raters MI Background and Experience by MOS*

MOS	MEAN GRADE	MEAN YRS ARMY	MEAN YRS MOS	MEAN FIELD ASSIGNMENTS	MEAN TRNG COURSES
96B	E-6	12.3	9.1	3	2
96D	E-6	8.5	7.1	3	3
96H	E-6	12.5	8.9	3	2
96R	E-6	14.4	12.1	3	2
97B	E-6	10.8	5.6	3	2
97E	E-6	10.4	7.7	3	2
97G	E-6	15.0	13.3	3	2
TOTAL: MEANS	E-6	11.9	9	3	2

* MEANS ROUNDED TO NEAREST RATIONAL NUMBER

It seems reasonable to conclude that the 65 raters in this study do qualify as subject matter experts in their MOSs and that, with appropriate tools, they should be able to describe the constituent elements of the jobs and tasks they must perform.

Ability and Skill Characteristics of the 96 CMF MOSs

Data will now be reported on each of the seven 96 CMF MOSs assessed in this research. In the following pages, an abilities and skills analysis will be given for each MOS individually. Appendix D provides complete data tables for every rater in each MOS by all 50 abilities. Appendix E provides summary data tables for the intelligence production activity judgements.

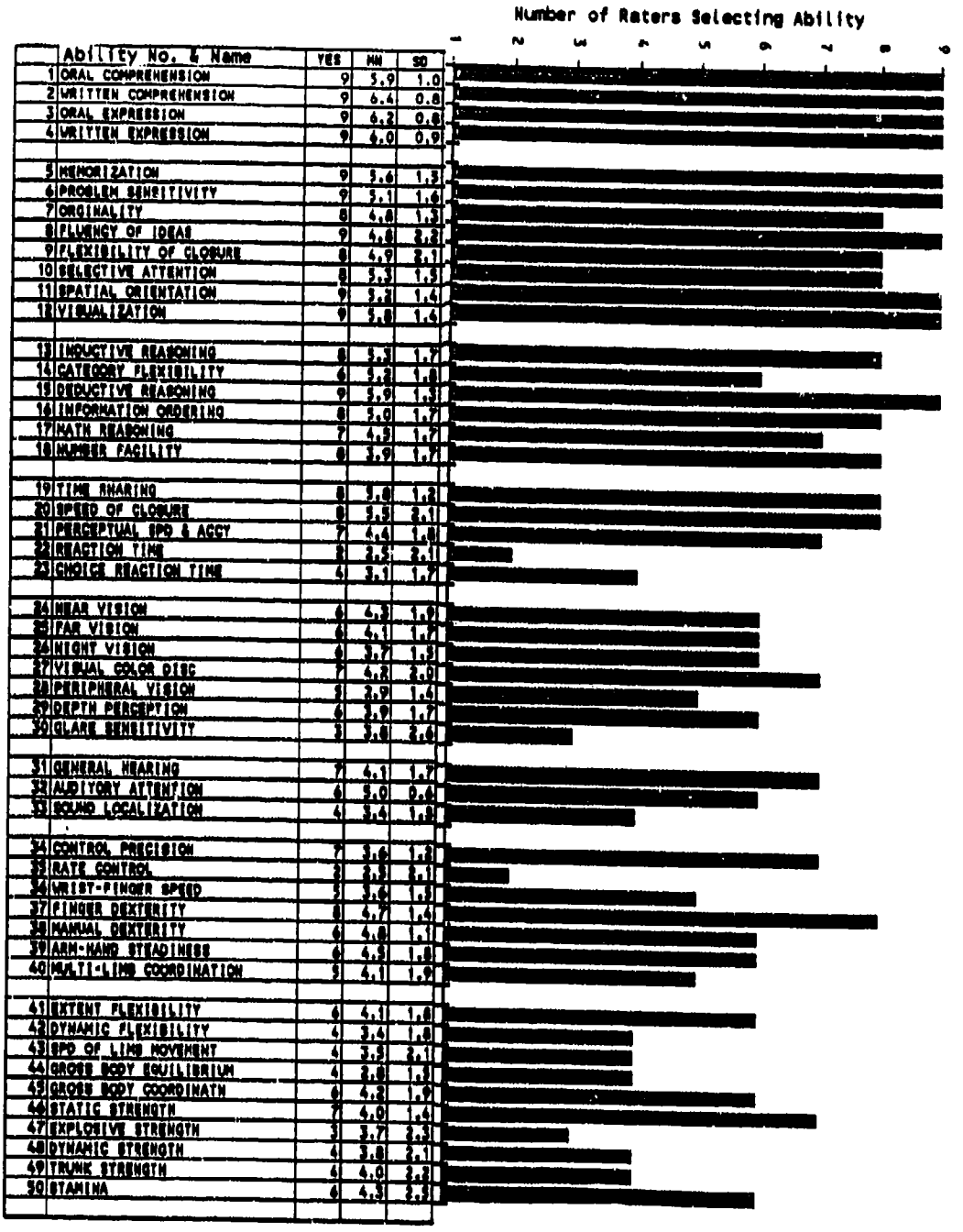
MOS 96B: Intelligence Analyst

An Intelligence Analyst is concerned with the collection, processing, and dissemination of combat military intelligence, both strategic and tactical. The analyst assesses the significance and reliability of incoming information, integrates it with current intelligence holdings, and processes the information so that it can be used. Processing includes the preparation of reports, estimates, plans, and briefings, as well as the establishment and maintenance of situation maps, intelligence overlays, intelligence records, and files. An analyst continually evaluates the importance of incoming information and promptly informs superiors when it has immediate tactical value. The analyst assembles intelligence information from all possible sources and identifies gaps and collection requirements (Department of the Army, 1989, p. 744; Muckler, Seven, & Akman, 1990a, p. 31-32).

What abilities and skills are needed to do this job? Figure 11 summarizes judgements made by nine SMEs who rated MOS 96B with respect to 50 specific abilities required and how much of each ability is necessary. In the figure, abilities are listed in numerical order. The number of raters who said the ability is required for the MOS is shown in the "Yes" column. The table also includes the mean and standard deviation of the responses of the raters when asked how much of the ability (on a scale of 1 to 7) is required.

The bar graph portion of the figure makes it possible to see quickly where the emphasis is for MOS 96B. All of the abilities in the first two groups, communication cluster and conceptual cluster, are important. There is strong agreement that they are needed, and the scalar values indicating how much of each ability is needed are high. The next group, the reasoning cluster, is also important for 96B. Of the six abilities in the cluster, four are selected. Two of the abilities in the fourth cluster, TIME SHARING and SPEED OF CLOSURE, are important; the scalar values assigned to them (5.8 and 5.5, respectively) are high.

Thus, of the first 20 abilities in the taxonomy, 18 are considered necessary for MOS 96B. All of these abilities are



	Ability No. & Name	YES	MN	SD
1	ORAL COMPREHENSION	9	5.9	1.0
2	WRITTEN COMPREHENSION	9	6.4	0.8
3	ORAL EXPRESSION	9	6.2	0.8
4	WRITTEN EXPRESSION	9	6.0	0.9
5	MEMORIZATION	9	5.6	1.3
6	PROBLEM SENSITIVITY	9	5.1	1.6
7	ORGINALITY	8	4.8	1.3
8	FLUENCY OF IDEAS	9	4.8	2.2
9	FLEXIBILITY OF CLOSURE	8	4.9	2.1
10	SELECTIVE ATTENTION	8	5.5	1.5
11	SPATIAL ORIENTATION	9	5.3	1.4
12	VISUALIZATION	9	5.8	1.4
13	INDUCTIVE REASONING	8	5.5	1.7
14	CATEGORY FLEXIBILITY	6	5.2	1.8
15	DEDUCTIVE REASONING	9	5.9	1.3
16	INFORMATION ORDERING	8	5.0	1.7
17	MATH REASONING	7	4.5	1.7
18	NUMBER FACILITY	8	5.9	1.7
19	TIME SHARING	8	5.8	1.2
20	SPEED OF CLOSURE	8	5.5	2.1
21	PERCEPTUAL SPD & ACCY	7	4.4	1.8
22	REACTION TIME	2	2.5	2.1
23	CHOICE REACTION TIME	4	3.1	1.7
24	NEAR VISION	6	4.3	1.9
25	FAR VISION	6	4.1	1.7
26	NIGHT VISION	6	3.7	1.3
27	VISUAL COLOR DISC	7	4.3	2.0
28	PERIPHERAL VISION	3	2.9	1.4
29	DEPTH PERCEPTION	6	3.9	1.7
30	GLARE SENSITIVITY	3	3.0	2.0
31	GENERAL HEARING	7	4.1	1.7
32	AUDITORY ATTENTION	6	5.0	0.6
33	SOUND LOCALIZATION	4	3.4	1.8
34	CONTROL PRECISION	7	5.6	1.2
35	RATE CONTROL	3	2.5	2.1
36	WRIST-FINGER SPEED	5	3.6	1.3
37	FINGER DEXTERITY	8	4.7	1.4
38	MANUAL DEXTERITY	6	4.0	1.1
39	ARM-HAND STEADINESS	6	4.5	1.8
40	MULTI-LIMB COORDINATION	5	4.1	1.9
41	EXTENT FLEXIBILITY	6	4.1	1.8
42	DYNAMIC FLEXIBILITY	4	3.4	1.8
43	SPD OF LIMB MOVEMENT	4	3.5	2.1
44	GROSS BODY EQUILIBRIUM	4	2.8	1.5
45	GROSS BODY COORDINATN	6	4.2	1.9
46	STATIC STRENGTH	7	4.0	1.4
47	EXPLOSIVE STRENGTH	3	3.7	2.3
48	DYNAMIC STRENGTH	4	3.8	2.1
49	TRUNK STRENGTH	4	4.0	2.8
50	STAMINA	4	4.3	2.5

Figure 11. SME judgments on abilities needed for MOS 96B.

ones often referred to generically as cognitive abilities. The overall picture that emerges from the judgements of the SMEs is that of a job which places heavy demands on a wide variety of cognitive abilities. Not just a few but almost all of the cognitive abilities included in this taxonomy were identified as important to 96B and, in most instances, quite a bit of each ability was judged necessary. Evidently, the cognitive demands of the various tasks to be done by MOS 96B are many, varied, and fairly heavy.

In terms of the rest of the taxonomy, the picture is quite different. Only one psychomotor ability, FINGER DEXTERITY, made the cutoff. None of the other abilities in the psychomotor cluster, none of the perceptual abilities, visual or auditory, and none of the gross motor skills was considered necessary by enough of the SMEs to be included in the 96B profile. Clearly, the emphasis for this MOS is on abilities associated with communication and with thinking. Physical demands are not ordinarily a major part of the job.

The bar graph portion of the chart also makes it possible to see in concrete terms the effect of the level of rater agreement criterion that is adopted on which abilities are included in the profile for the MOS. The topic was discussed at length earlier in this report. In these discussions of specific MOSs, inclusion in a profile is based on a level of rater agreement of 80%. The figure illustrates the impact of varying the criterion. A different profile, narrower and more or less conservative depending on one's viewpoint, would emerge if 100% agreement were required. The MOS 96B profile would contain only 10 abilities instead of the 19 abilities included at the 80% level. Accepting 78% agreement would produce a profile with 25 abilities for MOS 96B.

The 19 abilities considered essential for 96B with the 80% criterion adopted here as a standard are listed in Table 15. In this table, the abilities are grouped by the number of raters selecting them (10 were chosen unanimously). Within each group, the abilities are ordered by the average estimate of how much of the ability is needed. The list reaffirms what was shown in figure: the major requirement for 96B is the ability to understand language, written or spoken, and to communicate that understanding to others. Although the ability to read and to speak are rated highest, all the communication abilities are scaled high. With a single exception (FINGER DEXTERITY), all of the remaining abilities listed in the table focus on cognitive demands, and only one of them (NUMBER FACILITY) is rated below the psychomotor abilities in terms of how much is needed.

Another profile for MOS 96B is presented in Figure 12. It is based on clusters rather than on individual abilities and so reflects a different level of abstraction. To construct it, the

Table 15

MOS 96B: Essential Abilities and Skills

Ability No. & Name		YES	MN	SD
2	WRITTEN COMPREHENSION	9	6.4	0.8
3	ORAL EXPRESSION	9	6.2	0.8
4	WRITTEN EXPRESSION	9	6.0	0.9
1	ORAL COMPREHENSION	9	5.9	1.0
15	DEDUCTIVE REASONING	9	5.9	1.3
12	VISUALIZATION	9	5.8	1.4
5	MEMORIZATION	9	5.6	1.5
11	SPATIAL ORIENTATION	9	5.2	1.4
6	PROBLEM SENSITIVITY	9	5.1	1.6
8	FLUENCY OF IDEAS	9	4.8	2.2
19	TIME SHARING	3	5.8	1.2
20	SPEED OF CLOSURE	8	5.5	2.1
13	INDUCTIVE REASONING	8	5.3	1.7
10	SELECTIVE ATTENTION	8	5.3	1.5
16	INFORMATION ORDERING	8	5.0	1.7
9	FLEXIBILITY OF CLOSURE	8	4.9	2.1
7	ORGINALITY	8	4.8	1.3
37	FINGER DEXTERITY	8	4.7	1.4
18	NUMBER FACILITY	8	3.9	1.7

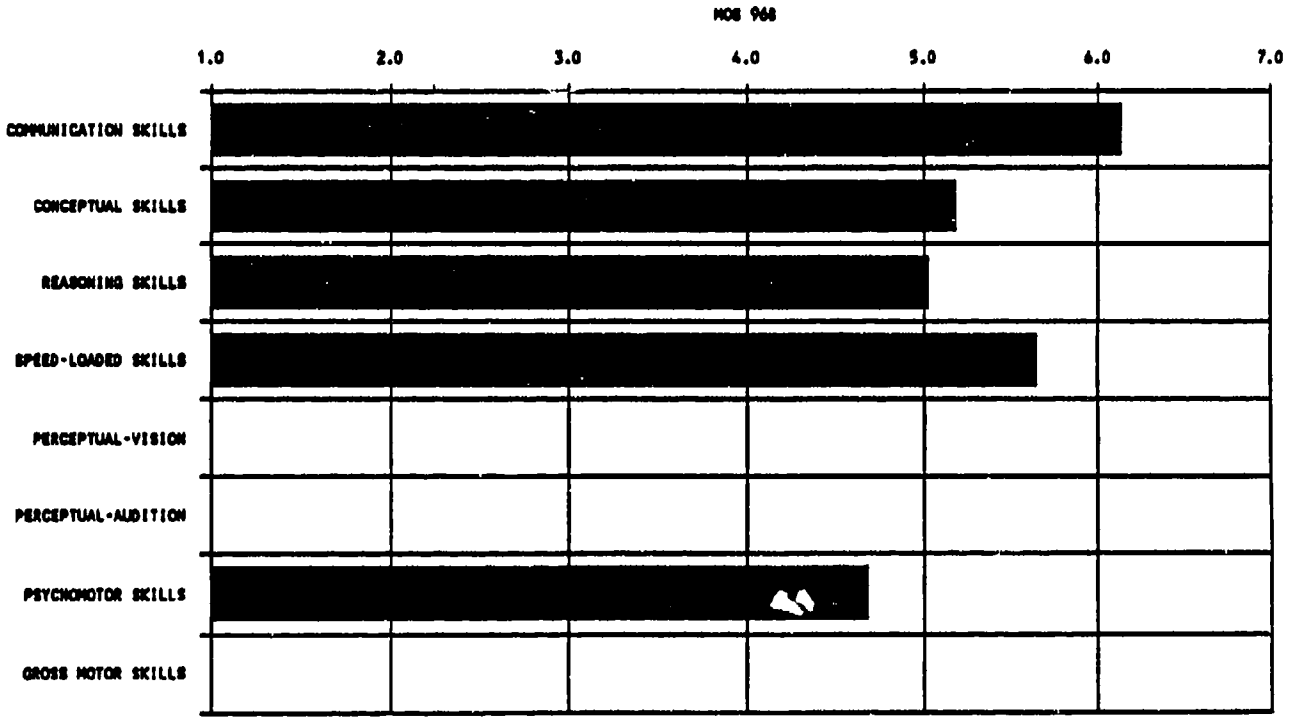


Figure 12. Cluster profile for MOS 96B.

abilities that met or exceeded the designated 80% level of rater agreement were identified. Then the scalar values of these abilities were averaged within each cluster and the means plotted. Thus, the mean shown for the communication cluster represents the average for all four communication abilities included in the taxonomy, but the mean for the speed-loaded cluster represents only the mean for the two speed-loaded abilities selected by eight raters. The abilities not included in the profile are not averaged into the cluster means.

This cluster profile tells some interesting and useful things about MOS 96B. It says that the demanding aspects of the job are not in the gross motor or perceptual areas. The heaviest demands are placed on the communication abilities, and fairly heavy demands also exist in four other areas, the conceptual, reasoning, speed-loaded, and psychomotor clusters. In general, the picture is consistent with that presented by the more detailed profile. However, it is not clear from the cluster profile how many of the abilities within the cluster are important to the job.

This distinction may be important in matching system requirements to MOSs. Consider a system judged to need RATE CONTROL at level 5.4 and MULTI-LIMB COORDINATION at level 4. If the system required no other psychomotor skills, the system profile for the psychomotor cluster would show a mean of 4.7. That is exactly the mean shown for MOS 96B, but what that mean represents in the 96B profile is FINGER DEXTERITY. What may appear to be a match at the cluster level may not be an actual match at the individual abilities level.

What this example points out is that abilities within clusters are not compensatory. Indeed, the process which led to the identification of the individual abilities (Fleishman & Quaintance, 1984) was designed to derive abilities that were as independent as possible. Cluster comparisons may speed and focus the matching process, and a cluster profile such as that in the figure is easier to assimilate than the 50 ability profile. Both profiles depict MOS 96B, and both may be useful. They represent descriptions at different levels of detail and specificity.

In Part C raters were asked to indicate what abilities are needed by MOS 96B to carry out eight intelligence production activities. If an 80% rater agreement level is used as the criterion, 11 abilities were assigned to the activities shown in Table 16. The table lists the abilities selected and the level of ability judged necessary for the activity using the 1 to 7 scale. The number of activities in which each listed ability is used varies from one to five for this MOS. The mean is 2.5 activities per ability. As the table indicates, one rating was near the top of the scale; the amount of WRITTEN EXPRESSION judged necessary for DISSEMINATING INFORMATION was 6.7. Needs

Table 16

Abilities Needed for Intelligence Production Activities: MOS 96B

ABILITY: Number/Name (Activities Requiring)	Amount of Ability by Activity*								Total Demand	Mean Demand
	P	S	C	M	A	I	P	D		
2. WRITTEN COMPREHENSION (5)	6.5		6.0	5.4	5.4	5.7			28.9	5.9
4. WRITTEN EXPRESSION (4)	5.3				5.8		5.7	6.7	23.5	5.9
15. DEDUCTIVE REASONING (3)	4.9				6.0	6.1			17.0	5.7
1. ORAL COMPREHENSION (3)	5.9		5.4			4.6			15.9	5.3
6. PROBLEM SENSITIVITY (3)	5.0	5.0			5.6				15.6	5.2
3. ORAL EXPRESSION (2)	6.1							6.2	12.3	6.2
8. FLUENCY OF IDEAS (3)	4.8						4.0	3.5	12.3	4.1
5. MEMORIZATION (2)	4.4						4.6		9.0	4.5
13. INDUCTIVE REASONING (1)					5.8				5.8	5.8
12. VISUALIZATION (1)						5.6			5.6	5.6
16. INFORMATION ORDERING (1)				4.9					4.9	4.9
No. Abilities/Activity	8	1	2	2	5	4	3	3		
Total Amount/Activity	42.8	5.0	11.4	10.3	28.6	22.0	14.3	16.4		
Mean Amount/Activity	5.4	5.0	5.7	5.2	5.7	5.5	4.8	5.5		

*P = PLANNING
S = SETTING-UP OR PREPARING
C = COLLECTING DATA
M = MANAGING OR CATALOGING DATA
A = ANALYZING OR EXPLOITING DATA
I = INTERPRETING DATA
P = PREPARING OUTPUTS
D = DISSEMINATING INFORMATION

for WRITTEN COMPREHENSION, DEDUCTIVE REASONING, and ORAL EXPRESSION were also judged to be 6 or greater for some of the activities.

By adding all the entries for each listed ability, a total demand for each ability can be obtained. The table shows this total and the abilities are listed in order from highest demand (WRITTEN COMPREHENSION = 28.9) to lowest (INFORMATION ORDERING = 4.9). The summary demand for an ability reflects both the number of activities using the ability and the amount of the ability needed. The final column of the table shows the mean level of the ability needed averaged across the number of activities requiring the ability. This calculation converts the numbers back to the 7-point scale. As can be seen, ORAL EXPRESSION has the highest mean level of ability needed 6.2, but it was judged necessary only to the PLANNING and DISSEMINATING INFORMATION activities; its total demand placed it in the middle of the 11 abilities.

At the bottom of the table are summary data showing how many abilities were identified as necessary for each activity; eight abilities were considered necessary for the first activity (PLANNING), only one for the second (SETTING-UP OR PREPARING) and the other six activities had from two to five abilities cited. Adding the amounts of the individual abilities needed for each activity gives an indication of the total amount for each activity. Again, PLANNING has the highest figure and SETTING-UP OR PREPARING the lowest. Taking the mean of these amounts reduces these numbers back to the 1-to-7 scale.

The means suggest that the COLLECTING DATA and ANALYZING OR EXPLOITING DATA activities needed the highest average level of ability, but the individual cell entries are probably better indicators of where training and selection attention should focus. Although the mean level of ability for PLANNING is 5.4, the demand for WRITTEN COMPREHENSION is 6.4, a full scale point higher, and as noted earlier the mean estimate for WRITTEN EXPRESSION in the DISSEMINATING INFORMATION activity is 6.7 although the overall mean for that activity is only 5.5. The total and mean amounts of abilities needed may provide some help in assessing the balance across activities.

The 11 abilities listed in the table comprise another profile of MOS 96B, one that might be designated a "C Profile" since it is based on data from Part C of JCATS. The 11 abilities in this C Profile are a subset of the 19 abilities selected by the raters in Part A. (In both cases, an 80% rater agreement level was the criterion for inclusion; at the 75% rater agreement level, the A and C lists are identical except for FLEXIBILITY OF CLOSURE). It is not surprising that the two profiles overlap since the raters were asked to use the abilities they selected in Part A when filling out Part C. However, the focus on the eight activities

is a shift from the orientation of the questions in the flow diagrams in Part A. Raters might not feel that all the abilities they chose in Part A were needed once they considered the Part C activities. Hence, overlaps in the lists were not inevitable since raters could eliminate or even add abilities.

Eight of the abilities selected in Part A were not identified in Part C as necessary for any of the eight activities specified in C. One ability that had been a unanimous rater choice in Part A, SPATIAL ORIENTATION, was omitted in Part C. Seven of the nine raters said it was needed for the SETTING-UP OR PREPARING and COLLECTING DATA activities, but that was not enough to reach the 80% criterion level for rater agreement.

Seven other abilities included in the Part A profile for MOS 96B (ORIGINALITY, FLEXIBILITY OF CLOSURE, SELECTIVE ATTENTION, NUMBER FACILITY, TIME SHARING, SPEED OF CLOSURE, and FINGER DEXTERITY) were not included in the Part C list. Seven of the nine raters cited six of these abilities (all but FLEXIBILITY OF CLOSURE) as necessary for one or more of the eight activities but that was also below 80%.

Whether the reduction from 19 to 11 abilities represents a honing down to the essence of the MOS ability profile or represents the exclusion of significant and essential activities from that profile is not clear. It is reassuring that there is agreement between the Part A and Part C profiles on 11 abilities. Since the Part A list includes the Part C list, the question to be resolved is which list is more useful or, perhaps more accurately, for what uses more or less inclusive lists of abilities may be appropriate.

MOS 96D: Imagery Analyst

An Imagery Analyst is concerned with obtaining useful and valid intelligence information by studying and analyzing aerial and ground imagery and by using electronic, optical, and mechanical devices to obtain information from permanent record images. The analyst identifies physical features or terrain, as well as enemy installations, deployments, weapons, equipment, defenses, and lines of communication. The analyst computes distances, areas, and volumes, with and without automated means, and determines field and target coordinates. The analyst prepares a variety of graphics: situation maps, map overlays, plots, mosaics, charts, etc. The analyst plans imagery collection missions, briefs and debriefs crews, assesses mission coverage, and makes recommendations for future missions. The analyst prepares imagery reports, determines imagery analysis priorities, prepares and maintains target folders and imagery analysis files (Department of the Army, 1989, p. 747; Muckler, Seven, & Akman 1990a, p. 32).

Figure 13 shows the judgements of ten SMEs on the abilities and skills needed to do this job. It is clear from a brief inspection of the figure that the abilities most important for MOS 96D are located among the first 30 that are listed. The raters agreed that all four communication abilities, oral and written comprehension and expression, are necessary and in considerable amounts. Abilities in the communication cluster are almost equally important, but the next four clusters call for a closer look.

Eight abilities are included in the conceptual cluster. Four of them, MEMORIZATION, PROBLEM SENSITIVITY, SELECTIVE ATTENTION, and SPATIAL ORIENTATION, met criterion for inclusion in the 96D profile. Furthermore, the scalar values assigned them indicate that quite a lot of each ability is needed. None of the selected abilities rated below 5.3. Clearly, some of the cognitive aspects of the 96D job are demanding.

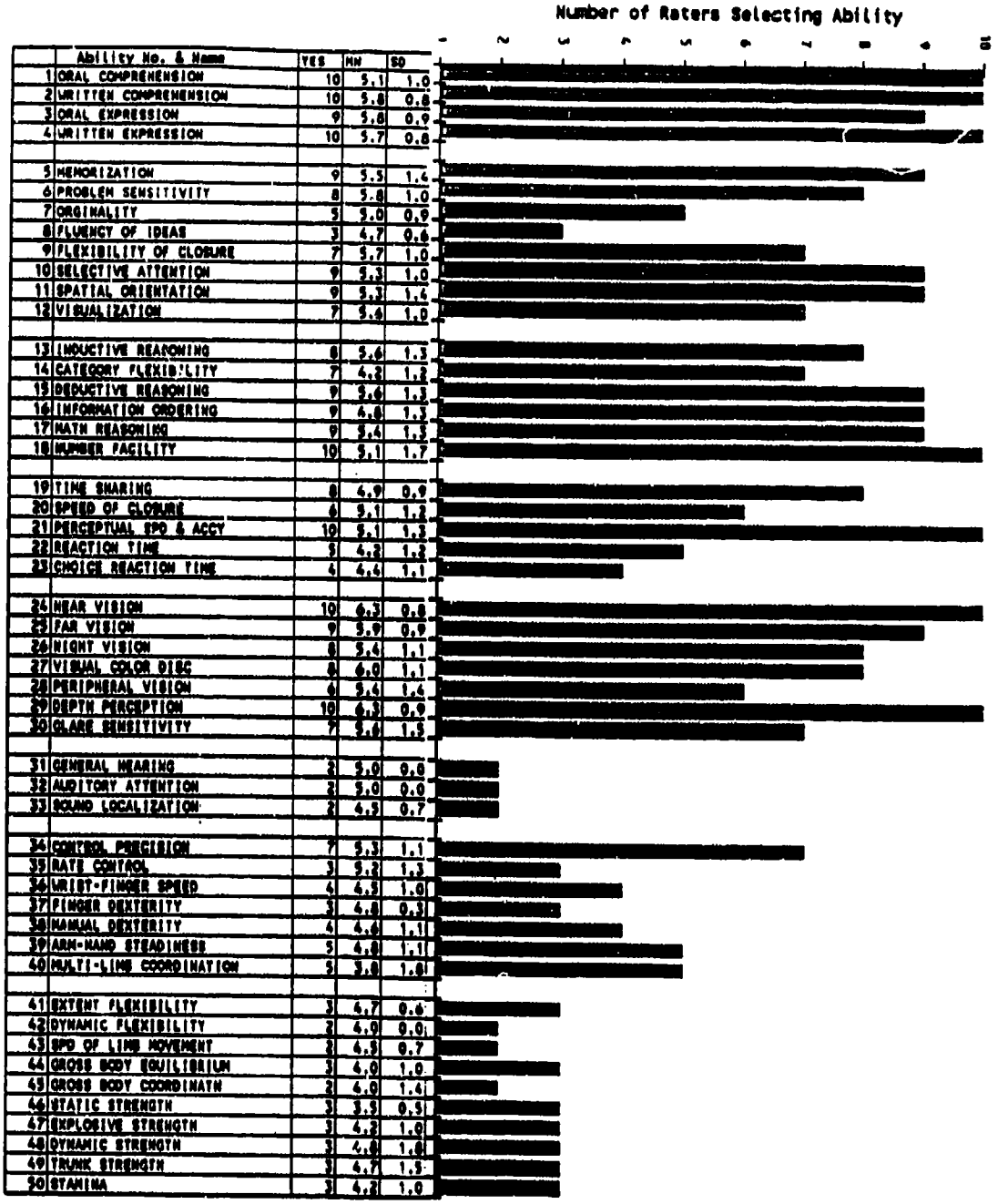
Of the six abilities in the reasoning cluster, five made the profile; NUMBER FACILITY was a unanimous choice. Except for INFORMATION ORDERING at 4.8, all of the selected abilities rated above 5 on amount needed.

Two abilities from the next cluster are included in the profile, PERCEPTUAL SPEED AND ACCURACY and TIME SHARING. They add to the picture of 96D as a job with a considerable cognitive load, a job with a variety of facets, broadly not narrowly demanding, requiring a sensitivity to time and to competing interests.

The sixth cluster deals with visual perception and the profile in the figure shows that this is a primary focus of this MOS. Five of the eight specific visual abilities listed in the cluster are included in the 96D profile. Two of the abilities, NEAR VISION and DEPTH PERCEPTION, were unanimous selections and both had average scalar values of 6.3 indicating that a large amount of these abilities is needed. VISUAL COLOR DISCRIMINATION at 6.0 and FAR VISION at 5.9 were also highly rated.

Abilities in the remaining three clusters were not considered important for MOS 96D. That is, none of the hearing abilities, none of the psychomotor abilities, and none of the gross motor abilities were considered essential by enough of the raters to be included in the individual abilities and skills profile.

What the figure says in brief is that MOS 96D is a job with a fairly broad and high level cognitive demand and with an emphasis on visual perception and communication abilities. The individual abilities to be included in the 96D profile are listed in Table 17 in order, first, of the number of raters selecting them and, then, within each group (10, 9, or 8 raters), in order of the mean scalar value given to that ability. Topping the list are



	Ability No. & Name	YES	MN	SD
1	ORAL COMPREHENSION	10	5.1	1.0
2	WRITTEN COMPREHENSION	10	5.8	0.6
3	ORAL EXPRESSION	9	5.8	0.9
4	WRITTEN EXPRESSION	10	5.7	0.8
5	MEMORIZATION	9	5.5	1.4
6	PROBLEM SENSITIVITY	8	5.8	1.0
7	ORGINALITY	5	5.0	0.9
8	FLUENCY OF IDEAS	3	4.7	0.6
9	FLEXIBILITY OF CLOSURE	7	5.7	1.0
10	SELECTIVE ATTENTION	9	5.3	1.0
11	SPATIAL ORIENTATION	9	5.3	1.4
12	VISUALIZATION	7	5.4	1.0
13	INDUCTIVE REASONING	8	5.6	1.3
14	CATEGORY FLEXIB'LITY	7	4.3	1.2
15	DEDUCTIVE REASONING	9	5.6	1.3
16	INFORMATION ORDERING	9	4.8	1.3
17	MATH REASONING	9	5.4	1.3
18	NUMBER FACILITY	10	5.1	1.7
19	TIME SHARING	8	4.9	0.9
20	SPEED OF CLOSURE	6	5.1	1.2
21	PERCEPTUAL SPD & ACCY	10	5.1	1.3
22	REACTION TIME	5	4.8	1.2
23	CHOICE REACTION TIME	4	4.6	1.1
24	NEAR VISION	10	6.3	0.8
25	FAR VISION	9	5.9	0.9
26	NIGHT VISION	8	5.6	1.1
27	VISUAL COLOR DISC	8	6.0	1.1
28	PERIPHERAL VISION	6	5.6	1.6
29	DEPTH PERCEPTION	10	6.3	0.9
30	GLARE SENSITIVITY	7	5.6	1.5
31	GENERAL HEARING	2	5.0	0.0
32	AUDITORY ATTENTION	2	5.0	0.0
33	SOUND LOCALIZATION	2	4.5	0.7
34	CONTROL PRECISION	7	5.3	1.1
35	RATE CONTROL	3	5.3	1.3
36	WRIST-FINGER SPEED	4	4.5	1.0
37	FINGER DEXTERITY	3	4.8	0.3
38	MANUAL DEXTERITY	4	4.6	1.1
39	ARM-HAND STEADINESS	5	4.8	1.1
40	MULTI-LIMB COORDINATION	5	5.8	1.8
41	EXTENT FLEXIBILITY	3	4.7	0.6
42	DYNAMIC FLEXIBILITY	2	4.0	0.0
43	SPD OF LIMB MOVEMENT	2	4.5	0.7
44	GROSS BODY EQUILIBRIUM	3	4.0	1.0
45	GROSS BODY COORDINATN	2	4.0	1.4
46	STATIC STRENGTH	3	3.3	0.5
47	EXPLOSIVE STRENGTH	3	4.3	1.0
48	DYNAMIC STRENGTH	3	4.8	1.8
49	TRUNK STRENGTH	3	4.7	1.5
50	STAMINA	3	4.2	1.0

Figure 13. SME judgments on abilities needed for MOS 96D.

Table 17

MOS 96D: Essential Abilities and Skills

Ability No. & Name		YES	MN	SD
24	NEAR VISION	10	6.3	0.8
29	DEPTH PERCEPTION	10	6.3	0.9
2	WRITTEN COMPREHENSION	10	5.8	0.8
4	WRITTEN EXPRESSION	10	5.7	0.8
21	PERCEPTUAL SPD & ACCY	10	5.1	1.3
1	ORAL COMPREHENSION	10	5.1	1.0
18	NUMBER FACILITY	10	5.1	1.7
25	FAR VISION	9	5.9	0.9
3	ORAL EXPRESSION	9	5.8	0.9
15	DEDUCTIVE REASONING	9	5.6	1.3
5	MEMORIZATION	9	5.5	1.4
17	MATH REASONING	9	5.4	1.3
10	SELECTIVE ATTENTION	9	5.3	1.0
11	SPATIAL ORIENTATION	9	5.3	1.4
16	INFORMATION ORDERING	9	4.8	1.3
27	VISUAL COLOR DISC	8	6.0	1.1
6	PROBLEM SENSITIVITY	8	5.8	1.0
13	INDUCTIVE REASONING	8	5.6	1.3
26	NIGHT VISION	8	5.4	1.1
19	TIME SHARING	8	4.9	0.9

two visual abilities, followed by the ability to read and to write. Throughout the 20 listed abilities, visual and communication abilities are interspersed with a variety of cognitive abilities.

Figure 14 presents a cluster profile of MOS 96D. It shows an emphasis on abilities in the first five clusters and a lack of interest in the last three clusters. It depicts a job with a principal requirement for visual perception, a need for good communication skills, and strong supporting requirements in a variety of cognitive areas. The figure suggests that any detailed analysis of this MOS focus on the first five ability clusters.

Table 18 shows the 17 abilities selected by the raters for MOS 96D in Part C. These 17 abilities were dispersed across all eight activities, with two abilities used in six activities, two abilities used in one activity apiece, and the other 13 abilities ranging from two to five abilities each. The mean number of activity assignments for MOS 96D was 3.1.

The summarization across activities shows that WRITTEN EXPRESSION, used in six activities, carries the highest total demand (35.9). INFORMATION ORDERING was assigned to as many activities and carried the second highest demand (32.5). Although these two abilities showed the highest overall demand, their average demand per activity (6.0 and 5.4) was below that of five visual and reasoning abilities. The overall demand for each of these five was below 14, less than half that of the three most frequently cited abilities; their mean demand ranged from 6.4 to 6.8. For three of these abilities, DEPTH PERCEPTION, NEAR VISION, and MATHEMATICAL REASONING, the mean demand was judged to be 6.8 on the 7-point scale. The values assigned these abilities are even higher in the context of specific intelligence production activities (i.e., Part C) than they were in Part B (where the two visual skills were rated 6.3 and MATHEMATICAL REASONING was rated 5.4).

The judgements of number of abilities used in the intelligence production activities by MOS 96D ranged from three abilities per activity (DISSEMINATING INFORMATION) to 13 abilities (INTERPRETING DATA). The INTERPRETING DATA activity had the highest total amount of ability judged necessary (81.8) and the highest mean amount needed per ability (on the 7-point scale, 6.3, tied with the ANALYZING OR EXPLOITING DATA activity). Although there is some variability from one activity to another, the mean amount of ability needed is quite high (5.0 to 6.3) for all eight activities. Two activities, ANALYZING OR EXPLOITING DATA and INTERPRETING DATA, appear to be the focal point for this MOS.

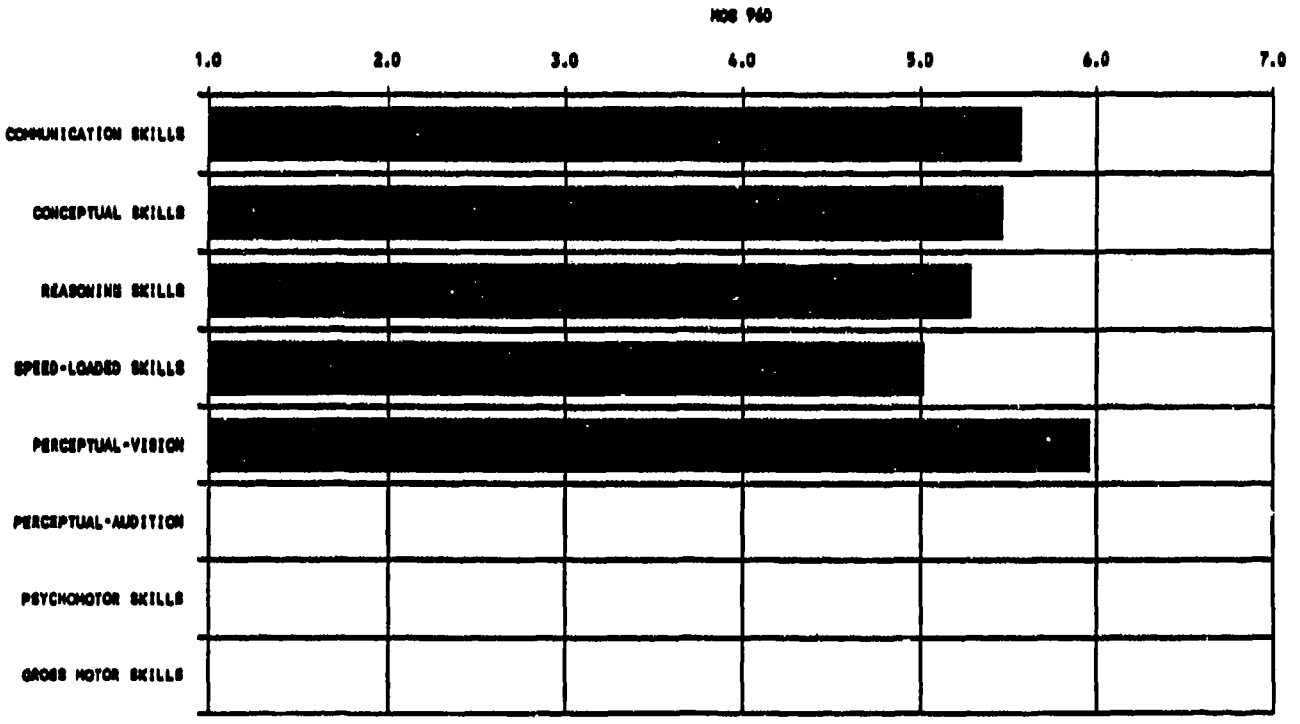


Figure 14. Cluster profile for MOS 96D.

Table 18

Abilities Needed for Intelligence Production Activities: MOS 96D

ABILITY: Number/Name (Activities Requiring)		Amount of Ability by Activity*								Total Demand	Mean Demand
		P	S	C	M	A	I	P	D		
4. WRITTEN EXPRESSION	(6)	5.8	5.1		5.2		6.1	6.9	6.8	35.9	6.0
16. INFORMATION ORDERING	(6)	5.1	4.6	5.6	5.6		6.2	5.4		32.5	5.4
10. SELECTIVE ATTENTION	(5)			5.9	5.8	6.1	5.9	5.6		29.3	5.9
2. WRITTEN COMPREHENSION	(4)	5.8		5.5		6.2	6.2			23.7	5.9
18. NUMBER FACILITY	(4)	5.2	5.0			6.4	6.2			22.8	5.7
21. PERCEPTUAL SPEED & ACCURACY	(4)					6.1	6.3	5.0	4.7	22.1	5.5
1. ORAL COMPREHENSION	(4)	5.4	4.8	4.5			4.9			19.6	4.9
3. ORAL EXPRESSION	(3)	5.6	5.4						6.6	17.6	5.9
29. DEPTH PERCEPTION	(2)					6.8	6.9			13.7	6.8
24. NEAR VISION	(2)					6.8	6.8			13.6	6.8
17. MATHEMATICAL REASONING	(2)					6.7	6.8			13.5	6.8
15. DEDUCTIVE REASONING	(2)					6.4	6.8			13.2	6.6
25. FAR VISION	(2)					6.4	6.4			12.8	6.4
5. MEMORIZATION	(2)					6.4	6.3			12.7	6.4
6. PROBLEM SENSITIVITY	(2)				4.3	5.4				9.7	4.8
19. TIME SHARING	(1)			5.9						5.9	5.9
11. SPATIAL ORIENTATION	(1)					5.5				5.5	5.5
No. Abilities/Activity		6	5	5	4	12	13	4	3		
Total Amount/Activity		32.9	24.9	27.4	20.9	75.1	81.8	22.9	18.1		
Mean Amount/Activity		5.5	5.0	5.5	5.2	6.3	6.3	5.7	6.0		

*P = PLANNING
S = SETTING-UP OR PREPARING
C = COLLECTING DATA
M = MANAGING OR CATALOGING DATA
A = ANALYZING OR EXPLOITING DATA
I = INTERPRETING DATA
P = PREPARING OUTPUTS
D = DISSEMINATING INFORMATION

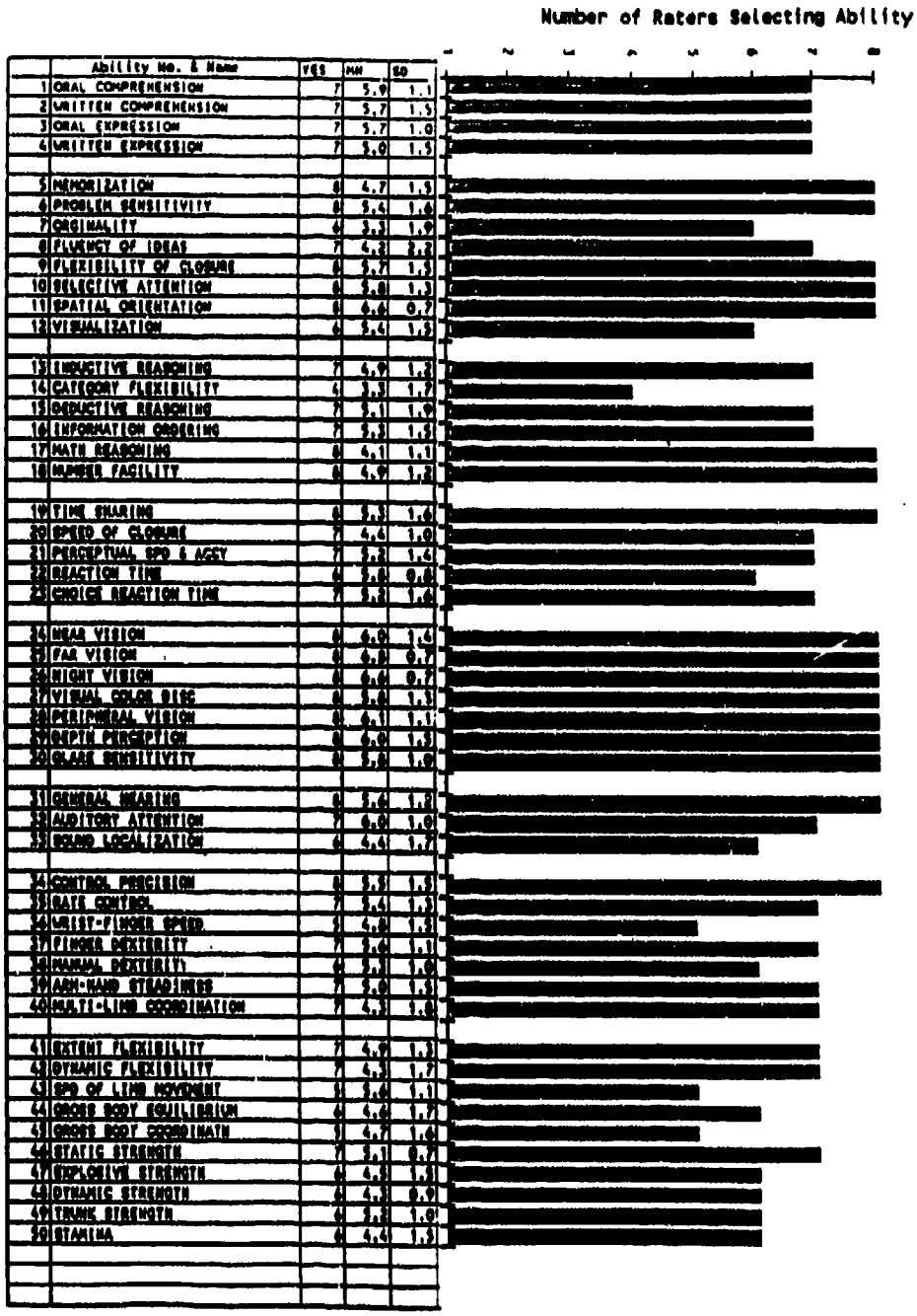
The 17 ability Part C profile of MOS 96D includes 17 of the 20 abilities that are in the Part A profile. The three abilities in the A profile that are not in the C profile are INDUCTIVE REASONING, NIGHT VISION, and VISUAL COLOR DISCRIMINATION. Seven out of ten raters (one fewer than needed to meet the 80% rater agreement criterion) selected these three abilities for the ANALYZING OR EXPLOITING DATA activity and the first two for the INTERPRETING DATA activity as well. Mean amounts assigned to the three were 6.8, 5.8, and 6.6, high on the 7-point scale. Essentially, there is much agreement about which abilities to include in the profile for MOS 96D, whether Part A or Part C provides the data.

MOS 96H: Aerial Intelligence Specialist

An Aerial Intelligence Specialist helps to plan and carries out aerial missions, including aerial surveillance, aerial visual reconnaissance, aerial search and rescue, aerial radiological surveys, and similar intelligence and information-gathering missions. In addition to using his unaided but trained eye, the 96H operates a variety of aerial sensor systems (infrared, radar, and photographic) and their associated data transmission links and ground data terminal stations. The 96H recognizes enemy electronic countermeasures, whether directed against aircraft or ground component communications or sensor equipment, and the 96H initiates electronic countermeasures. Prior to aerial missions, the 96H helps the pilot with flight planning, weather analysis, navigational computations, and aircraft preflight procedures. The 96H prepares aerial surveillance and associated equipment for operation, and the 96H troubleshoots sensor and associated systems when they fail. While airborne, the 96H reports on targets of opportunity, aids the pilot with aerial navigation, and uses the radio. The 96H participates in mission debriefings and helps the imagery analyst analyze imagery recordings (Department of the Army, 1989, p. 751; Muckler, Seven, & Akman 1990a, p. 33).

The judgements made by eight SMEs about the abilities required by MOS 96H are summarized in Figure 15. It shows the number of raters selecting each ability in the "Yes" column and graphs this number on the right side of the figure for ready comparison. The means and standard deviations of the scalar values assigned to the abilities are also included in the figure. With eight raters, at least seven must agree for the 80% criterion level to be met.

The figure makes it immediately apparent that visual perception is of primary importance to MOS 96H. All eight raters agreed that all seven visual abilities are necessary and that a high level of each is required. Although the visual perception cluster is the only one in which every rater said every ability was required, each of the other clusters contains abilities



	Ability No. & Name	YES	MN	SD
1	ORAL COMPREHENSION	7	5.9	1.1
2	WRITTEN COMPREHENSION	7	5.7	1.5
3	ORAL EXPRESSION	7	5.7	1.0
4	WRITTEN EXPRESSION	7	5.0	1.5
5	MEMORIZATION	8	4.7	1.5
6	PROBLEM SENSITIVITY	8	5.4	1.6
7	ORIGINALITY	6	3.3	1.9
8	FLUENCY OF IDEAS	7	4.3	2.2
9	FLEXIBILITY OF CLOSURE	8	5.7	1.5
10	SELECTIVE ATTENTION	8	5.8	1.3
11	SPATIAL ORIENTATION	8	6.6	0.7
12	VISUALIZATION	6	5.4	1.5
13	INDUCTIVE REASONING	7	4.9	1.2
14	CATEGORY FLEXIBILITY	4	3.3	1.7
15	DEDUCTIVE REASONING	7	5.1	1.9
16	INFORMATION ORDERING	7	5.3	1.5
17	MATH REASONING	8	4.1	1.1
18	NUMBER FACILITY	8	4.9	1.2
19	TIME SHARING	8	5.3	1.6
20	SPEED OF CLOSURE	7	4.6	1.0
21	PERCEPTUAL SPD & ACCY	7	5.3	1.5
22	REACTION TIME	6	5.0	0.8
23	CHOICE REACTION TIME	7	5.3	1.6
24	NEAR VISION	8	6.0	1.4
25	FAR VISION	8	6.3	0.7
26	NIGHT VISION	8	6.4	0.7
27	VISUAL COLOR DISC	8	5.8	1.3
28	PERIPHERAL VISION	8	6.1	1.1
29	DEPTH PERCEPTION	8	6.0	1.3
30	GLARE SENSITIVITY	8	5.8	1.0
31	GENERAL HEARING	8	5.6	1.2
32	AUDITORY ATTENTION	7	6.0	1.0
33	SOUND LOCALIZATION	6	4.5	1.7
34	CONTROL PRECISION	8	5.5	1.3
35	RATE CONTROL	7	5.4	1.3
36	WRIST-FINGER SPEED	5	4.0	1.3
37	FINGER DEXTERITY	7	5.0	1.1
38	MANUAL DEXTERITY	6	5.3	1.0
39	ARM-HAND STEADINESS	7	5.0	1.3
40	MULTI-LIMB COORDINATION	7	4.3	1.8
41	EXTENT FLEXIBILITY	7	4.9	1.3
42	DYNAMIC FLEXIBILITY	7	4.3	1.7
43	SPD OF LIMB MOVEMENT	5	3.6	1.1
44	GROSS BODY EQUILIBRIUM	6	4.8	1.7
45	GROSS BODY COORDINATN	5	4.7	1.6
46	STATIC STRENGTH	7	5.1	0.7
47	EXPLOSIVE STRENGTH	6	4.8	1.3
48	DYNAMIC STRENGTH	6	4.3	0.9
49	TRUNK STRENGTH	6	5.2	1.0
50	STAMINA	6	4.5	1.3

Figure 15. SME judgments on abilities needed for MOS 96H.

important for 96H. In the communication cluster, all four abilities were selected by seven raters. In the conceptual cluster, five abilities were unanimous selections and a sixth was picked by seven raters. In the reasoning cluster, only CATEGORY FLEXIBILITY failed to meet the criterion. In the speed-loaded cluster, only REACTION TIME was excluded from the profile, and six of the eight raters considered it necessary.

The final three clusters encompass 20 abilities; half of them met the criterion for inclusion in the 96H profile. Two of the three hearing abilities, GENERAL HEARING and AUDITORY ATTENTION were selected. Five of the seven psychomotor abilities were included in the profile with CONTROL PRECISION a unanimous choice. Finally, three of the gross motor abilities, EXTENT FLEXIBILITY, DYNAMIC FLEXIBILITY, and STATIC STRENGTH, were selected.

Table 19 lists the 36 abilities included in the 96H profile. As the table shows, 17 of the selections were unanimous and another 19 were chosen by seven of the eight raters. As the table also shows, the amounts of the abilities needed were quite high, FAR VISION rated at 6.8 (on a scale of 7) being the highest and MATHEMATICAL REASONING at 4.1 the lowest. The six most important abilities include five visual perception abilities and SPATIAL ORIENTATION. Each of the six is rated at least 6.0, suggesting the need for highly skilled personnel with exceptional visual abilities supported by wide-ranging cognitive abilities, highly developed psychomotor abilities, and specific kinds of flexibility and strength.

As might be anticipated, the cluster profile of MOS 96H, shown in Figure 16, indicates requirements at high levels in each of the eight clusters. The perceptual-vision demand is greatest, with perceptual-audition a close runner-up, but the balance shown across the clusters in the figure indicates that 96H is a very demanding job and suggests that detailed consideration of specific abilities in all clusters might be warranted.

Table 20 presents the data obtained from Part C for MOS 96H. There are 31 abilities represented in this C profile. The greatest number of activities to which any one ability is assigned is three; 21 of the 31 abilities are assigned to only one activity. The mean number of activities per ability is 1.5. Three activities (MANAGING OR CATALOGING DATA, ANALYZING OR EXPLOITING DATA, INTERPRETING DATA) have no abilities assigned to them at all.

Partly as a consequence of being represented in few activities, the total demands across abilities are low. The highest total demand is only 14.2 (ORAL COMPREHENSION); the low is 3.7 (FLUENCY OF IDEAS and INDUCTIVE REASONING). The average demand per ability ranges from a high of 6.4 (FAR VISION) to a

Table 19

MOS 96H: Essential Abilities and Skills

Ability No. & Name		YES	MN	SD
25	FAR VISION	8	6.8	0.7
11	SPATIAL ORIENTATION	8	6.6	0.7
26	NIGHT VISION	8	6.6	0.7
28	PERIPHERAL VISION	8	6.1	1.1
24	NEAR VISION	8	6.0	1.4
29	DEPTH PERCEPTION	8	6.0	1.5
10	SELECTIVE ATTENTION	8	5.8	1.3
27	VISUAL COLOR DISC	8	5.8	1.3
30	GLARE SENSITIVITY	8	5.8	1.0
9	FLEXIBILITY OF CLOSURE	8	5.7	1.5
31	GENERAL HEARING	8	5.6	1.2
34	CONTROL PERCISION	8	5.5	1.5
6	PROBLEM SENSITIVITY	8	5.4	1.6
19	TIME SHARING	8	5.3	1.6
18	NUMBER FACILITY	8	4.9	1.2
5	MEMORIZATION	8	4.7	1.5
17	MATH REASONING	8	4.1	1.1
32	AUDITORY ATTENTION	7	6.0	1.0
1	ORAL COMPREHENSION	7	5.9	1.1
2	WRITTEN COMPREHENSION	7	5.7	1.5
3	ORAL EXPRESSION	7	5.7	1.0
37	FINGER DEXTERITY	7	5.6	1.1
35	RATE CONTROL	7	5.4	1.3
16	INFORMATION ORDERING	7	5.3	1.5
21	PERCEPTUAL SPD & ACCY	7	5.2	1.4
23	CHOICE REACTION TIME	7	5.2	1.6
15	DEDUCTIVE REASONING	7	5.1	1.9
46	STATIC STRENGTH	7	5.1	0.7
4	WRITTEN EXPRESSION	7	5.0	1.5
39	ARM-HAND STEADINESS	7	5.0	1.5
13	INDUCTIVE REASONING	7	4.9	1.2
41	EXTENT FLEXIBILITY	7	4.9	1.3
20	SPEED OF CLOSURE	7	4.4	1.0
40	MULTI-LIMB COORDINATION	7	4.3	1.8
42	DYNAMIC FLEXIBILITY	7	4.3	1.7
8	FLUENCY OF IDEAS	7	4.2	2.2

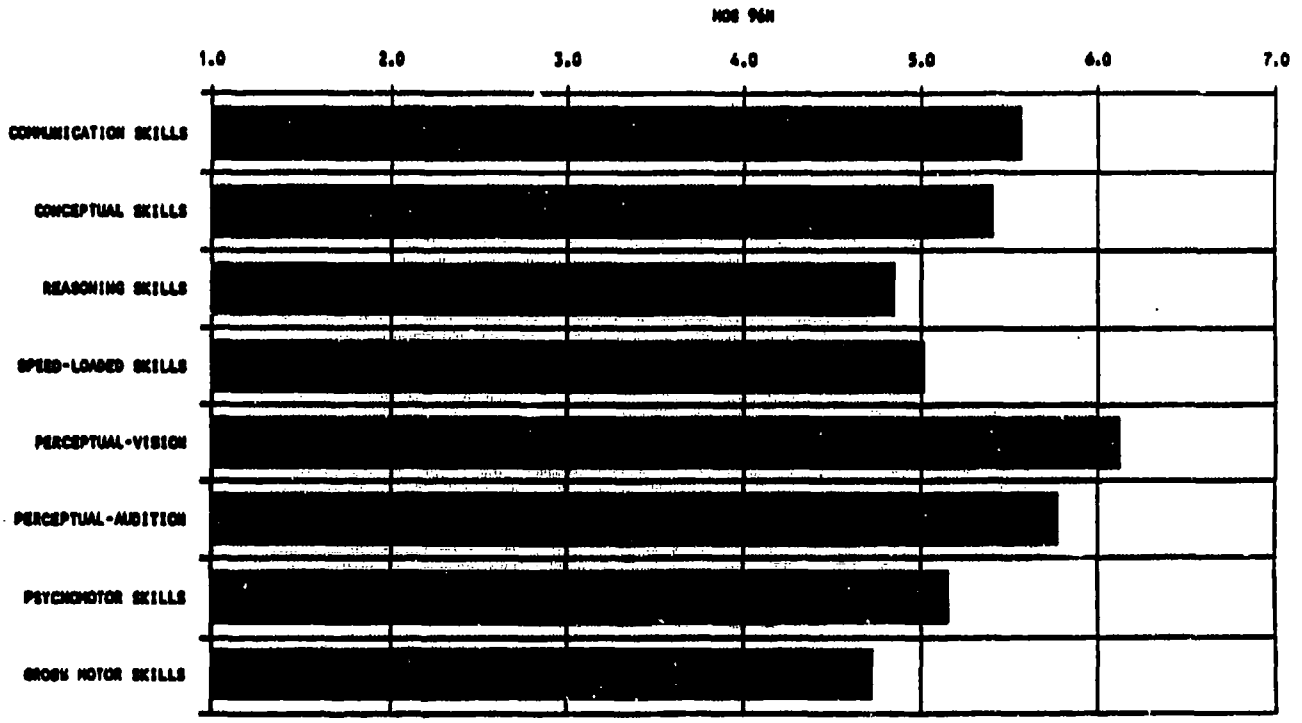


Figure 16. Cluster profile for MOS 96H.

Table 20

Abilities Needed for Intelligence Production Activities: MOS 96H

ABILITY: Number/Name (Activities Requiring)	Amount of Ability by Activity*								Total Demand	Mean Demand
	P	S	C	M	A	I	P	D		
3. ORAL COMPREHENSION (3)	5.1	4.8						4.3	14.2	4.7
1. ORAL EXPRESSION (3)	4.4	5.0						4.4	13.8	4.6
2. WRITTEN COMPREHENSION (3)	4.8	4.8						3.6	13.2	4.4
4. WRITTEN EXPRESSION (3)	4.3						3.0	3.6	10.9	3.6
24. NEAR VISION (3)		4.3	5.5						9.8	4.9
16. INFORMATION ORDERING (2)	4.8	4.8							9.6	4.8
5. MEMORIZATION (2)	4.8	4.4							9.2	4.6
19. TIME SHARING (2)		4.1	4.8						8.9	4.4
15. DEDUCTIVE REASONING (2)	4.4	4.1							8.5	4.2
17. MATHEMATICAL REASONING (2)	3.6	3.4							7.0	3.5
25. FAR VISION (1)			6.6						6.4	6.4
26. NIGHT VISION (1)			6.1						6.1	6.1
28. PERIPHERAL VISION (1)			5.9						5.9	5.9
11. SPATIAL ORIENTATION (1)			5.6						5.6	5.6
27. VISUAL COLOR DISCRIM. (1)			5.5						5.5	5.5
21. PERCEPTUAL SPEED & ACCURACY (1)			5.4						5.4	5.4
29. DEPTH PERCEPTION (1)			5.3						5.4	5.4
31. GENERAL HEARING (1)			5.3						5.3	5.3
10. SELECTIVE ATTENTION (1)			5.2						5.2	5.2
9. FLEXIBILITY OF CLOSURE (1)			5.1						5.1	5.1
23. CHOICE REACTION TIME (1)			5.1						5.1	5.1
30. GLARE SENSITIVITY (1)			5.1						5.1	5.1
20. SPEED OF CLOSURE (1)			4.7						4.7	4.7
35. RATE CONTROL (1)			4.7						4.7	4.7
37. FINGER DEXTERITY (1)			4.7						4.7	4.7
6. PROBLEM SENSITIVITY (1)		4.6							4.6	4.6
41. EXTENT FLEXIBILITY (1)			4.6						4.6	4.6
34. CONTROL PRECISION (1)			4.1						4.1	4.1
18. NUMBER FACILITY (1)	4.0								4.0	4.0
8. FLUENCY OF IDEAS (1)	3.7								3.7	3.7
13. INDUCTIVE REASONING (1)			3.7						3.7	3.7
No. Abilities/Activity	10	10	20	0	0	0	1	4		
Total Amount/Activity	43.9	44.3	102.9	0	0	0	3.0	15.9		
Mean Amount/Activity	4.4	5.1	5.1	0	0	0	3.0	4.0		

*P = PLANNING
S = SETTING-UP OR PREPARING
C = COLLECTING DATA
M = MANAGING OR CATALOGING DATA
A = ANALYZING OR EXPLOITING DATA
I = INTERPRETING DATA
P = PREPARING OUTPUTS
D = DISSEMINATING INFORMATION

low of 3.5 (MATHEMATICAL REASONING). In only one other case is the amount of ability needed judged to be 6 or higher (NIGHT VISION at 6.1).

The number of abilities needed per activity ranges from a high of 20 (COLLECTING DATA) to a low of 1 (PREPARING OUTPUTS), if the three activities without ability entries (at the 80% rater agreement level) are excluded. The COLLECTING DATA activity also has the highest total amount of ability needed per activity (102.9) and the highest mean amount per activity (5.1).

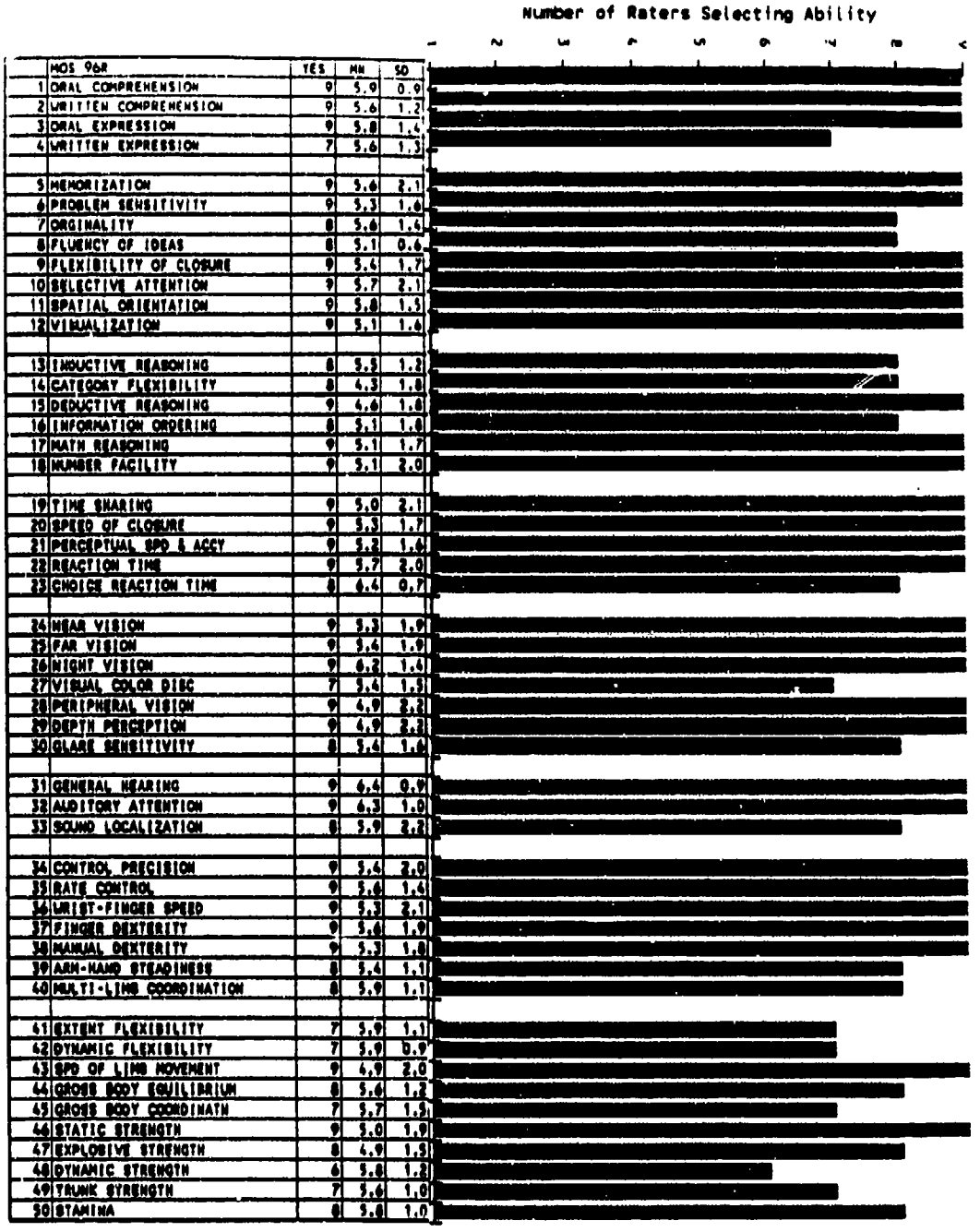
This characterization of MOS 96H shows a need for a variety of abilities. The first two activities listed call on seven of the same abilities but the third activity, COLLECTING DATA, uses 18 abilities that are not used in the other activities.

As with MOS 96B and MOS 96D, the abilities in the C profile for MOS 96H are a subset of the abilities in the A profile for that MOS. Of the 36 abilities selected as necessary for MOS 96H in Part A, 31 were used in assigning abilities to activities in Part C. The five abilities from the A profile not in the C profile are AUDITORY ATTENTION, ARM-HAND STEADINESS, MULTI-LIMB COORDINATION, DYNAMIC FLEXIBILITY, and STATIC STRENGTH. All five were assigned to the COLLECTING DATA activity and two to the SETTING-UP OR PREPARING activity by six of the eight raters, so that with a 75% level of rater agreement as a criterion, both A and C profiles would have included the same 36 abilities.

MOS 96R: Ground Surveillance Systems Operator

A Ground Surveillance Systems Operator detects, locates, and reports target data by operating ground surveillance systems and associated equipment. The operator selects emplacement sites for specific equipment, emplaces, camouflages, and recovers the system components. The operator also operates organic communications equipment, power sources, and light wheeled vehicles. The operator maintains the ground surveillance systems and associated equipment, as well as the light wheeled vehicles, the communications equipment, and the power sources. The operator reconnoiters potential areas of operation, plans surveillance missions, and must read and use military maps, overlays, aerial photographs, terrain studies, and intelligence reports. The operator also prepares overlays and situation maps. The operator decides on employment and operational techniques for the ground surveillance equipment and integrates other unit collection assets with ground surveillance systems (Department of the Army 1989, p. 753; Muckler, Seven, & Akman, 1990a p. 34).

The judgements made by nine SMEs about the abilities and skills required for MOS 96R are shown in Figure 17. The figure indicates that the raters believed many of the abilities and skills in each of the eight clusters were necessary for 96R.



	MOS 96R	YES	MN	SD
1	ORAL COMPREHENSION	9	5.9	0.9
2	WRITTEN COMPREHENSION	9	5.6	1.2
3	ORAL EXPRESSION	9	5.8	1.4
4	WRITTEN EXPRESSION	7	5.6	1.3
5	MEMORIZATION	9	5.6	2.1
6	PROBLEM SENSITIVITY	9	5.3	1.6
7	ORGINALITY	8	5.6	1.4
8	FLUENCY OF IDEAS	8	5.1	0.6
9	FLEXIBILITY OF CLOSURE	9	5.4	1.7
10	SELECTIVE ATTENTION	9	5.7	2.1
11	SPATIAL ORIENTATION	9	5.8	1.5
12	VISUALIZATION	9	5.1	1.6
13	INDUCTIVE REASONING	8	5.5	1.2
14	CATEGORY FLEXIBILITY	8	4.3	1.8
15	DEDUCTIVE REASONING	9	4.6	1.6
16	INFORMATION ORDERING	8	5.1	1.0
17	MATH REASONING	9	5.1	1.7
18	NUMBER FACILITY	9	5.1	2.0
19	TIME SHARING	9	5.0	2.1
20	SPEED OF CLOSURE	9	5.3	1.7
21	PERCEPTUAL SPD & ACCY	9	5.2	1.6
22	REACTION TIME	9	5.7	2.0
23	CHOICE REACTION TIME	8	6.4	0.7
24	NEAR VISION	9	5.3	1.9
25	FAR VISION	9	5.4	1.9
26	NIGHT VISION	9	6.2	1.4
27	VISUAL COLOR DISC	7	5.4	1.5
28	PERIPHERAL VISION	9	4.9	2.2
29	DEPTH PERCEPTION	9	4.9	2.2
30	GLARE SENSITIVITY	8	5.4	1.6
31	GENERAL HEARING	9	6.4	0.9
32	AUDITORY ATTENTION	9	6.3	1.0
33	SOUND LOCALIZATION	8	5.9	2.2
34	CONTROL PRECISION	9	5.6	2.0
35	RATE CONTROL	9	5.6	1.6
36	WRIST-FINGER SPEED	9	5.3	2.1
37	FINGER DEXTERITY	9	5.6	1.9
38	MANUAL DEXTERITY	9	5.3	1.8
39	ARM-HAND STEADINESS	8	5.4	1.1
40	MULTI-LIMB COORDINATION	8	5.9	1.1
41	EXTENT FLEXIBILITY	7	5.9	1.1
42	DYNAMIC FLEXIBILITY	7	5.9	0.9
43	SPD OF LIMB MOVEMENT	9	4.9	2.0
44	GROSS BODY EQUILIBRIUM	8	5.6	1.2
45	GROSS BODY COORDINATN	7	5.7	1.5
46	STATIC STRENGTH	9	5.0	1.9
47	EXPLOSIVE STRENGTH	8	4.9	1.5
48	DYNAMIC STRENGTH	6	5.8	1.2
49	TRUNK STRENGTH	7	5.6	1.0
50	STAMINA	8	5.8	1.0

Figure 17. SME judgments on abilities needed for MOS 96R.

Indeed, it is easier to specify the abilities not chosen by the eight raters necessary for meeting the criterion than it is to note the abilities selected. Only seven of the 50 abilities are omitted from the 96R profile. WRITTEN EXPRESSION was selected by only seven raters and so was not included in the profile. All of the abilities in the next three clusters are included. Five of the seven visual perception abilities were unanimous choices. Eight of the nine raters picked GLARE SENSITIVITY, so it, too, is part of the 96R profile. Of the visual abilities, only VISUAL COLOR DISCRIMINATION, selected by seven raters, did not make the cutoff. All three of the hearing abilities were considered necessary for 96R, and all seven of the psychomotor abilities. Of the ten abilities in the gross motor cluster, five met the criterion for inclusion in the profile and five did not, but all were deemed important by at least two-thirds of the raters. The five included in the profile are SPEED OF LIMB MOVEMENT, GROSS BODY EQUILIBRIUM, STATIC STRENGTH, EXPLOSIVE STRENGTH, and STAMINA.

The picture of MOS 96R drawn by the raters is of a highly demanding job, balanced between cognitive tasks of complex nature, psychomotor tasks calling for controlled manipulation and skilled performance, and physically difficult work. Six of the nine raters selected every one of the 50 abilities as necessary for MOS 96R. The 80% agreement criterion cut the number of abilities in the 96R profile to the 43 abilities listed in Table 21. In this table, the abilities are grouped according to the number of raters selecting them and then by the mean scalar value assigned to the ability. As the table shows, 30 of the 50 abilities were selected unanimously. The top three are perceptual abilities, all rated over 6 on the 7-point scale. From there on there is a mix of abilities from the various clusters, all highly rated.

Figure 18 presents a cluster profile for MOS 96R. That figure highlights the requirement for auditory abilities and suggests a somewhat lighter load on reasoning abilities than on the other clusters of abilities, but significant demands exist in every one of the eight clusters. In the selections made, none of the ability areas were omitted and all of the ratings were fairly high.

Part C data for MOS 96R are summarized in Table 22. As the table shows, there are 39 abilities included in the C profile. Two of these abilities (ORAL EXPRESSION and WRITTEN COMPREHENSION) are assigned to all eight activities; 13 of the 39 are assigned to only one activity and nine others to only two activities. The mean number of activities per ability is 2.8.

The amount of ability needed summarized across activities varies from 40.8 for ORAL EXPRESSION to 4.8 for GLARE

Table 21

MOS 96R: Essential Abilities and Skills

Ability No. & Name		YES	MN	SD
31	GENERAL HEARING	9	6.4	0.9
32	AUDITORY ATTENTION	9	6.3	1.0
26	NIGHT VISION	9	6.2	1.4
1	ORAL COMPREHENSION	9	5.9	0.9
11	SPATIAL ORIENTATION	9	5.8	1.5
3	ORAL EXPRESSION	9	5.8	1.4
10	SELECTIVE ATTENTION	9	5.7	2.1
22	REACTION TIME	9	5.7	2.0
2	WRITTEN COMPREHENSION	9	5.6	1.2
5	MEMORIZATION	9	5.6	2.1
35	RATE CONTROL	9	5.6	1.4
37	FINGER DEXTERITY	9	5.6	1.9
9	FLEXIBILITY OF CLOSURE	9	5.4	1.7
25	FAR VISION	9	5.4	1.9
34	CONTROL PRECISION	9	5.4	2.0
6	PROBLEM SENSITIVITY	9	5.3	1.6
20	SPEED OF CLOSURE	9	5.3	1.7
24	NEAR VISION	9	5.3	1.9
36	WRIST-FINGER SPEED	9	5.3	2.1
38	MANUAL DEXTERITY	9	5.3	1.8
21	PERCEPTUAL SPD & ACCY	9	5.2	1.6
12	VISUALIZATION	9	5.1	1.6
17	MATH REASONING	9	5.1	1.7
18	NUMBER FACILITY	9	5.1	2.0
19	TIME SHARING	9	5.0	2.1
46	STATIC STRENGTH	9	5.0	1.9
28	PERIPHERAL VISION	9	4.9	2.2
29	DEPTH PERCEPTION	9	4.9	2.2
43	SPD OF LIMB MOVEMENT	9	4.9	2.0
15	DEDUCTIVE REASONING	9	4.6	1.8
23	CHOICE REACTION TIME	8	6.4	0.7
33	SOUND LOCALIZATION	8	5.9	2.2
40	MULTI-LIMB COORDINATION	8	5.9	1.1
50	STAMINA	8	5.8	1.0
7	ORGINALITY	8	5.6	1.4
44	GROSS BODY EQUILIBRIUM	8	5.6	1.2
13	INDUCTIVE REASONING	8	5.5	1.2
30	GLARE SENSITIVITY	8	5.4	1.6
39	ARM-HAND STEADINESS	8	5.4	1.1
8	FLUENCY OF IDEAS	8	5.1	0.6
16	INFORMATION ORDERING	8	5.1	1.8
47	EXPLOSIVE STRENGTH	8	4.9	1.5
14	CATEGORY FLEXIBILITY	8	4.3	1.8

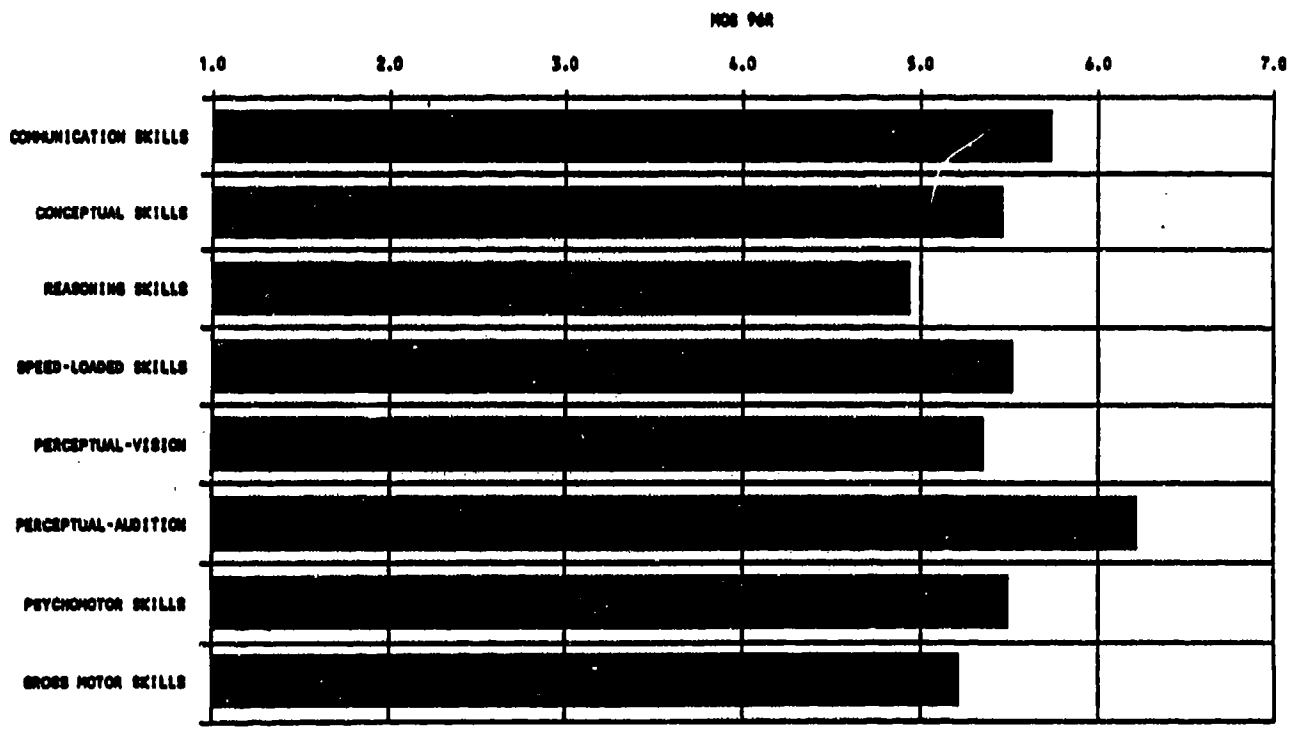


Figure 18. Cluster profile for MOS 96R.

Table 22

Abilities Needed for Intelligence Production Activities: MOS 96R

ABILITY: Number/Name (Activities Requiring)	Amount of Ability by Activity*								Total Demand	Mean Demand
	P	S	C	M	A	I	P	D		
3. ORAL EXPRESSION (8)	4.8	4.7	4.8	5.1	5.4	5.5	5.2	5.3	40.8	5.1
2. WRITTEN COMPREHENSION (8)	5.6	4.3	5.3	5.1	5.3	5.6	4.3	4.6	40.1	5.0
22. REACTION TIME (6)			5.5	5.3	5.0	4.9	4.6	5.3	30.6	5.1
6. PROBLEM SENSITIVITY (6)	4.9	5.7			5.0	4.9	4.8	4.8	30.1	5.0
17. MATHEMATICAL REASONING (6)		5.1	4.8	4.8		4.4	4.8	4.2	28.1	4.7
18. NUMBER FACILITY (5)		4.7		4.8		4.7	4.7	4.5	23.4	4.7
10. SELECTIVE ATTENTION (4)			5.6			5.9	5.4	5.4	22.3	5.6
19. TIME SHARING (4)			5.4	4.9		4.9		4.9	20.1	5.0
34. CONTROL PRECISION (4)			5.6			5.1	4.3	4.4	19.4	4.8
21. PERCEPTUAL SPEED & ACCURACY (4)			5.4			4.9	4.4	4.4	19.1	4.8
1. ORAL COMPREHENSION (4)	4.8	5.0					4.3	4.6	18.7	4.7
24. NEAR VISION (4)		4.6	4.9				4.5	4.4	18.4	4.6
26. NIGHT VISION (3)		5.9	5.6				5.6		17.1	5.7
12. VISUALIZATION (3)	5.2	5.8			5.3				16.3	5.4
5. MEMORIZATION (3)	5.4	5.3	5.3						16.0	5.3
37. FINGER DEXTERITY (3)		5.4	5.8		4.8				16.0	5.3
9. FLEXIBILITY OF CLOSURE (3)			5.2		4.6	5.3			15.1	5.0
36. WRIST-FINGER SPEED (2)		5.6	5.8						11.4	5.7
31. GENERAL HEARING (2)			5.9			5.4			11.3	5.7
11. SPATIAL ORIENTATION (2)		5.7	5.4						11.1	5.6
43. SPEED OF LIMB MOVEMENT (2)		5.2	5.8						11.0	5.5
4. WRITTEN EXPRESSION (2)		5.0					5.7		10.7	5.4
35. RATE CONTROL (2)		5.4			5.0				10.4	5.2
29. DEPTH PERCEPTION (2)		5.0	5.3						10.3	5.2
15. DEDUCTIVE REASONING (2)			5.0					4.6	9.6	4.8
20. SPEED OF CLOSURE (2)		4.8			4.7				9.5	4.8
23. CHOICE REACTION TIME (1)			6.1						6.1	6.1
40. MULTI-LIMB COORDINATION (1)		5.9							5.9	5.9
32. AUDITORY ATTENTION (1)			5.7						5.7	5.7
46. STATIC STRENGTH (1)		5.7							5.7	5.7
47. EXPLOSIVE STRENGTH (1)		5.7							5.7	5.7
33. SOUND LOCALIZATION (1)			5.6						5.6	5.6
38. MANUAL DEXTERITY (1)		5.6							5.6	5.6
28. PERIPHERAL VISION (1)		5.4							5.4	5.4
13. INDUCTIVE REASONING (1)			5.3						5.3	5.3
39. ARM-HAND STEADINESS (1)		5.3							5.3	5.3
25. FAR VISION (1)		5.1							5.1	5.1
44. GROSS BODY EQUILIBRIUM (1)		5.1							5.1	5.1
30. GLAZE SENSITIVITY (1)			4.8						4.8	4.8
No. Abilities/Activity	6	26	24	6	9	12	13	13		
Total Amount/Activity	30.7	137.0	129.9	30.0	45.1	61.5	62.6	61.4		
Mean Amount/Activity	5.1	5.3	5.4	5.0	5.0	4.8	4.8	4.7		

*P = PLANNING
S = SETTING-UP OR PREPARING
C = COLLECTING DATA
M = MANAGING OR CATALOGING DATA
A = ANALYZING OR EXPLOITING DATA
I = INTERPRETING DATA
P = PREPARING OUTPUTS
D = DISSEMINATING INFORMATION

SENSITIVITY, used only in the COLLECTING DATA activity. Although this variation in total demand is large, the mean ability required does not vary greatly from one ability to another. The highest mean demand is that for CHOICE REACTION TIME (6.1), used only in the COLLECTING DATA activity. The second highest mean demand is that for MULTI-LIMB COORDINATION (5.9), used only in SETTING-UP OR PREPARING. Simple REACTION TIME also appears as a major factor for MOS 96R; it shows the third highest total demand and appears in six activities. The mean demand for those six is 5.1. A need for action and for speed of action is suggested by these data.

The lowest mean demand, that for NEAR VISION, is 4.6, not really a low figure on the 7-point scale; that mean is based on four activities to which the ability was assigned. None of the individual cell entries for the 39 abilities is below 4; the raters' judgements indicate that MOS 96R places demands on a wide range of abilities and that the demands are moderately and consistently high.

With respect to the number of abilities need to perform the eight activities, the range runs from 6 to 26 abilities per activity. SETTING-UP OR PREPARING and COLLECTING DATA are the two activities showing the major demands, with 26 abilities for SETTING-UP OR PREPARING and 24 abilities for COLLECTING DATA. Between these two activities there is an overlap on 11 abilities and differences in the other abilities these activities need (15 and 13 in number, respectively). PLANNING and MANAGING OR CATALOGING DATA are two activities needing the fewest abilities for MOS 96R (6 each).

The mean amount of ability needed per activity ranges from a high of 5.4 (COLLECTING DATA) to a low of 4.7 (DISSEMINATING INFORMATION), indicating that the demand across activities with respect to level of ability needed is fairly balanced. The total amount of ability per activity mirrors the differences observed in number of abilities needed. The largest totals in each case are for the SETTING-UP OR PREPARING and COLLECTING DATA activities. The total amount for SETTING-UP OR PREPARING is 137.0, for COLLECTING DATA 129.9. The next closest activity in terms of total amount of ability needed is less than half that. INTERPRETING DATA, PREPARING OUTPUTS, and DISSEMINATING INFORMATION (61.5, 62.6, and 61.4) are nearly equal to one another and roughly twice that of the two lowest demand activities, PLANNING (30.7) and MANAGING OR CATALOGING DATA (30.0). In terms of these ability profiles, the emphasis for MOS 96R is clearly on the SETTING-UP OR PREPARING and COLLECTING DATA phases of the job.

Of the 39 abilities represented in the C profile, 38 were included among the 43 abilities in the A profile. The C profile included one ability (WRITTEN EXPRESSION) not in the A profile,

and the A profile included five abilities (ORIGINALITY, FLUENCY OF IDEAS, CATEGORY FLEXIBILITY, INFORMATION ORDERING, and STAMINA) not in the C profile. In each case, a 75% rater agreement level would have included these abilities in the respective profiles whereas the 80% criterion did not. Both profiles include a selection of abilities from each of the eight ability clusters. MOS 96R clearly is judged to need a high level of a wide variety of abilities.

MOS 97B: Counterintelligence Agent

A Counterintelligence Agent plans and conducts counterintelligence operations, analyzing, selecting, exploiting, and neutralizing targets of counterintelligence interest in a tactical environment. The Agent determines enemy intelligence collection assets, organizations, personnel, operational methods, capabilities, vulnerabilities, limitations, and missions. The Agent supports offensive and defensive counterintelligence and collection operations and gathers counterintelligence information. The Agent is familiar with the methods and practices of saboteurs, foreign agents, and subversives. The Agent formulates investigation plans and evaluates information sources. The Agent plans and conducts counterintelligence investigations, including background, complaint, and incident investigations. The Agent applies the fundamentals of military and civil law to the conduct of investigations. The Agent conducts security surveys and provides other counterintelligence security services (Department of the Army, 1989, p. 756; Muckler, Seven, & Akman, 1990a, p. 34).

Figure 19 summarizes the assessments made by 10 97B SMEs concerning the abilities and skills needed for performance in this MOS. The figure presents the number of raters who selected the ability, the mean importance judged for each ability, the standard deviation for each mean, and the profile created when the number of raters selecting the ability is plotted.

The importance of communication abilities (abilities 1 through 4) is apparent. Further, the importance of the next eight abilities (abilities 5 through 12) with respect to conceptual abilities is strong and well-balanced across these abilities. After ability #12, however, the pattern of essential abilities becomes rather ability-specific. Some abilities are rated as very important, others as moderately important, and some as of small importance.

Of the 50 abilities, some 22 are rated as essential by eight or more raters out of ten (using the 80% criterion assumed here). These abilities are shown in Table 23. Nine of the 22 are rated as essential by all ten raters; these unanimous choices are entirely from the first three clusters of abilities and concern

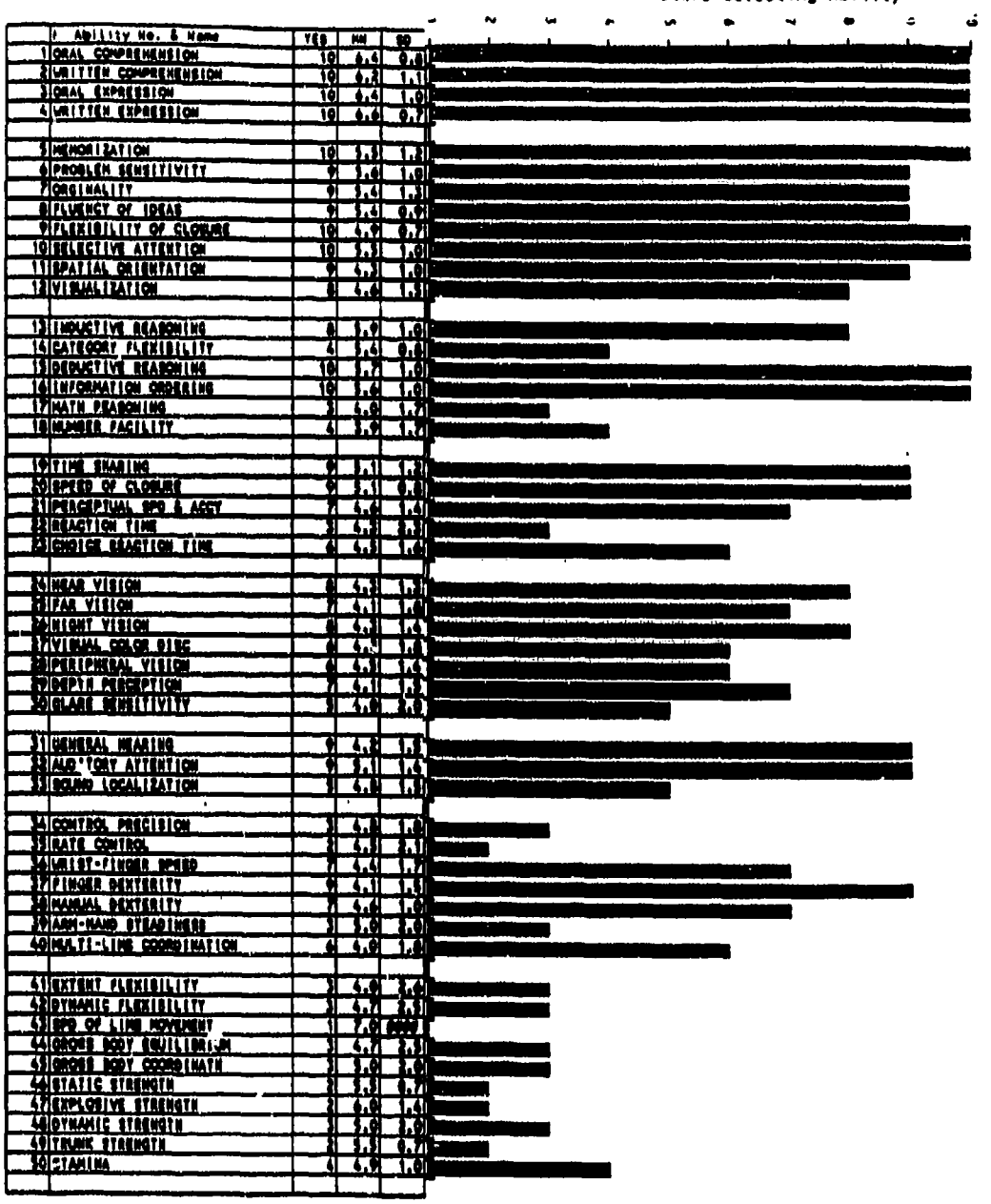


Figure 19. SME judgments on abilities needed for MOS 97B.

Table 23

MOS 97B: Essential Abilities and Skills

Ability No. & Name	YES	MN	SD
4 WRITTEN EXPRESSION	10	6.6	0.7
1 ORAL COMPREHENSION	10	6.4	0.8
3 ORAL EXPRESSION	10	6.4	1.0
2 WRITTEN COMPREHENSION	10	6.2	1.1
15 DEDUCTIVE REASONING	10	5.7	1.0
16 INFORMATION ORDERING	10	5.6	1.0
10 SELECTIVE ATTENTION	10	5.5	1.0
5 MEMORIZATION	10	5.5	1.2
9 FLEXIBILITY OF CLOSURE	10	4.9	0.7
6 PROBLEM SENSITIVITY	9	5.6	1.0
7 ORGINALITY	9	5.4	1.3
8 FLUENCY OF IDEAS	9	5.4	0.9
19 TIME SHARING	9	5.1	1.2
20 SPEED OF CLOSURE	9	5.1	0.8
32 AUDITORY ATTENTION	9	5.1	1.4
11 SPATIAL ORIENTATION	9	4.3	1.0
31 GENERAL HEARING	9	4.2	1.5
37 FINGER DEXTERITY	9	4.1	1.5
13 INDUCTIVE REASONING	8	5.9	1.0
12 VISUALIZATION	8	4.6	1.5
26 NIGHT VISION	8	4.3	1.4
24 NEAR VISION	8	4.3	1.3

communications, conceptual, and reasoning abilities. Once again, here is a military intelligence MOS that depends strongly on cognitive abilities and skills.

Beyond the cognitive abilities (i.e., abilities 1 through 23), there are abilities from other clusters that are designated as essential based on raters' judgements although not unanimous choices: GENERAL HEARING, FINGER DEXTERITY, NIGHT VISION, AUDITORY ATTENTION, and NEAR VISION.

Figure 20 assembles the clusters of abilities into eight areas. It can be seen there that the cognitive abilities are predominant in the performance of the tasks in this MOS. Still present but far less important are the abilities associated with perceptual-vision, perceptual-audition, and psychomotor abilities--with specific exceptions. The relative unimportance of the gross motor abilities can be seen both in the current and previous figures. An interesting sub-cluster is that of WRIST-FINGER SPEED, FINGER DEXTERITY, and MANUAL DEXTERITY which suggests this is not entirely a cognitive MOS and that some manual skill is not to be ignored.

Data from Part C for MOS 97B are summarized in Table 24. As the table shows, 13 abilities are assigned to as many as five different intelligence production activities. The mean number of activities per ability is 2.5. The total demand for an ability, summed across the number of activities in which it is represented, ranges from a high of 26.6 for WRITTEN EXPRESSION, used in five activities, to 3.8 for SPATIAL ORIENTATION, assigned only to PLANNING. The mean demand per ability ranges from that 3.8 up to 5.9 (ORAL COMPREHENSION). Communication, reasoning, and conceptual skills are intermixed and emphasized. Only one perceptual skill (AUDITORY ATTENTION) and one psychomotor skill (FINGER DEXTERITY) make the list, each appears in only one activity, and the mean demand for each is at the low end of the abilities represented in the C profile.

As shown at the bottom of the table, the number of abilities assigned to an activity ranges from eight (INTERPRETING DATA) to one (SETTING-UP OR PREPARING). The total amount of activity needed per activity goes from 40.7 (INTERPRETING DATA) to 5.0 (SETTING-UP OR PREPARING), paralleling the number of abilities involved. In addition to INTERPRETING DATA, three other activities, ANALYZING OR CATALOGING DATA (30.6), COLLECTING DATA (24.6), and PLANNING (23.9), show ability amounts above average for MOS 97B. The mean amount of ability needed per activity shows little variability, from 5.3 (PREPARING OUTPUTS) to 4.3 (PLANNING). Ability levels appear balanced within activities. The highest single demand is for ORAL COMPREHENSION (6.2) in the COLLECTING DATA activity; the second highest is for WRITTEN COMPREHENSION (5.9) in INTERPRETING DATA. The relatively high

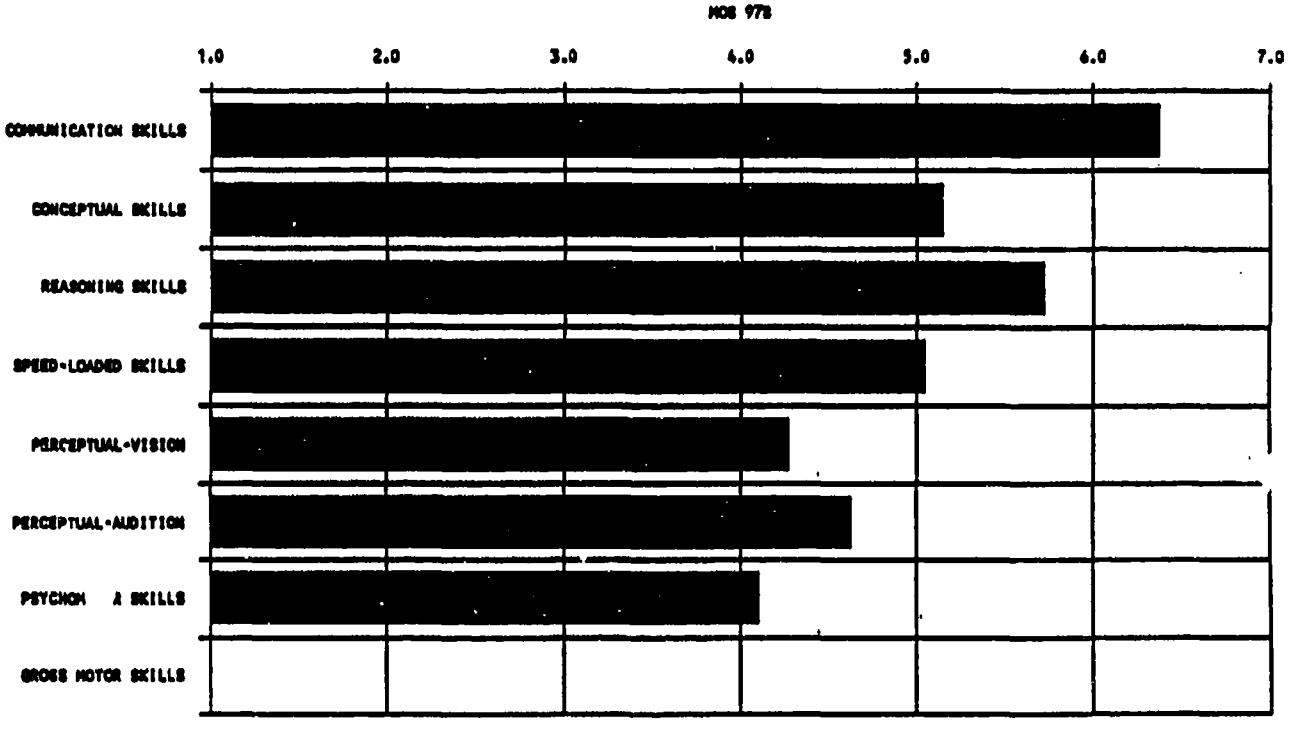


Figure 20. Cluster profile for MOS 97B.

Table 24

Abilities Needed for Intelligence Production Activities: MOS 97B

ABILITY: Number/Name (Activities Requiring)	Amount of Ability by Activity*								Total Demand	Mean Demand
	P	S	C	M	A	I	P	D		
4. WRITTEN EXPRESSION (5)				5.2	4.6	5.3	6.3	5.2	26.6	5.3
16. INFORMATION ORDERING (4)	5.5		4.1	5.2			5.6		20.4	5.1
3. ORAL EXPRESSION (4)	4.6	5.0	5.2					5.3	20.1	5.0
15. DEDUCTIVE REASONING (3)	5.1				5.8	5.7			16.6	5.5
6. PROBLEM SENSITIVITY (3)	4.9				4.8	5.1			14.8	4.9
1 ORAL COMPREHENSION (2)			6.2			5.6			11.8	5.9
2. WRITTEN COMPREHENSION (2)					5.5	5.9			11.4	5.7
9. FLEXIBILITY OF CLOSURE (2)					5.3	4.6			9.9	5.0
10. SELECTIVE ATTENTION (2)			4.6		4.6				9.2	4.6
20. SPEED OF CLOSURE (2)			4.5			4.5			9.0	4.5
37. FINGER DEXTERITY (1)							4.1		4.1	4.1
32. AUDITORY ATTENTION (1)						4.0			4.0	4.0
11. SPATIAL ORIENTATION (1)	3.8								3.8	3.8
No. Abilities/Activity	5	1	5	2	6	8	3	2		
Total Amount/Activity	23.9	5.0	24.6	10.4	30.6	40.7	16.0	10.5		
Mean Amount/Activity	4.8	5.0	4.9	5.2	5.1	5.1	5.3	5.2		

*P = PLANNING
S = SETTING-UP OR PREPARING
C = COLLECTING DATA
M = MANAGING OR CATALOGING DATA
A = ANALYZING OR EXPLOITING DATA
I = INTERPRETING DATA
P = PREPARING OUTPUTS
D = DISSEMINATING INFORMATION

total demand associated with INTERPRETING DATA is more a function of the number of abilities needed than the amount of each.

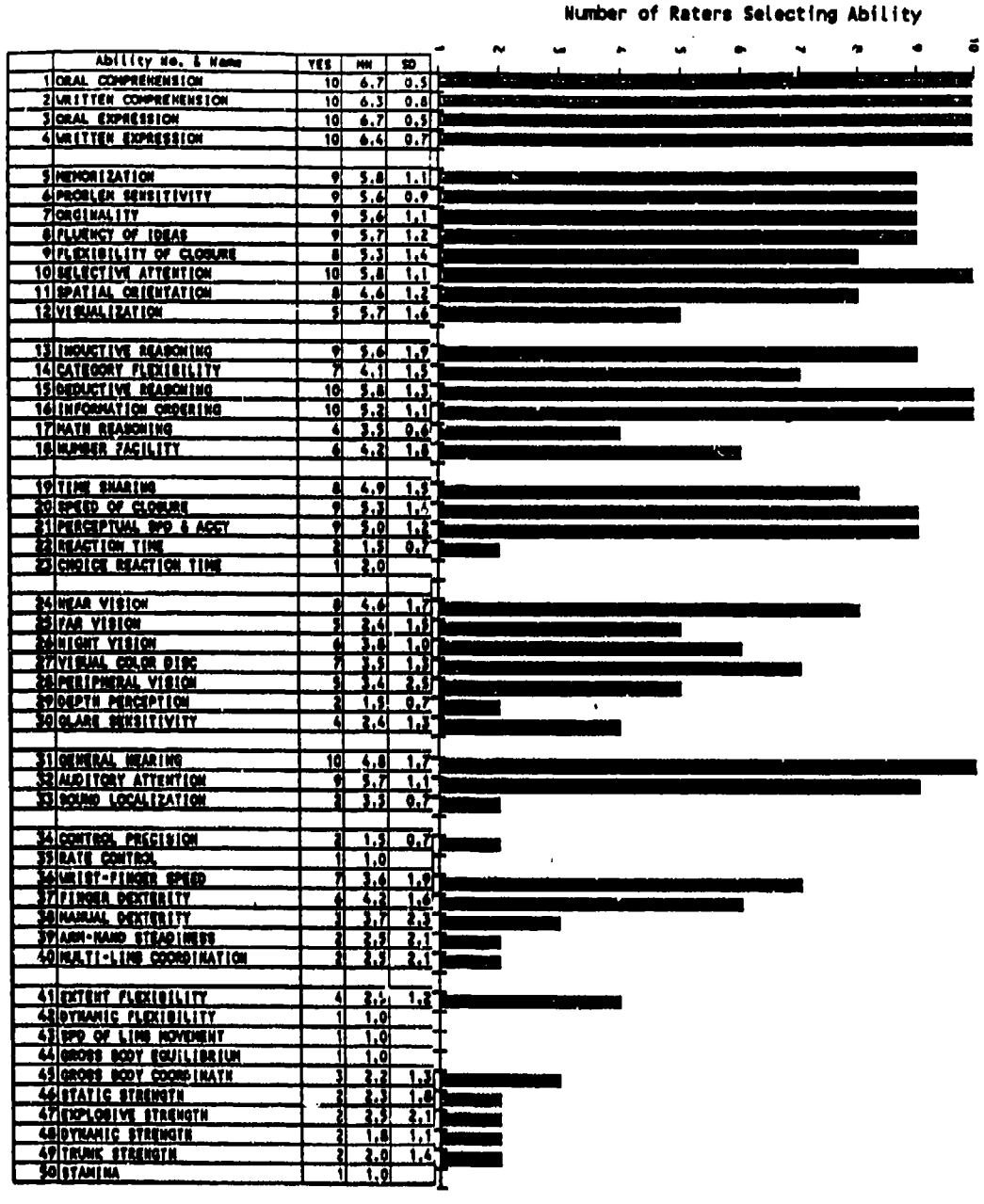
The 13 abilities included in the C profile are all among the 22 abilities in the A profile for MOS 97B. MEMORIZATION, a unanimous choice for the A profile, was not included in the C profile. Three additional conceptual abilities (ORIGINALITY, FLUENCY OF IDEAS, and VISUALIZATION) were in the A profile, as was one additional reasoning ability (INDUCTIVE REASONING). TIME SHARING and three perceptual abilities (NEAR VISION, NIGHT VISION, and GENERAL HEARING) were included in the A profile but not in the C. Both profiles included all four communication abilities, but the A profile included all eight abilities in the conceptual cluster while the C profile selected only half of them.

In doing Part C, seven of the nine raters assigned MEMORIZATION to seven of the eight activities in amounts ranging from 3.7 (MANAGING OR CATALOGING DATA) to 5.0 (COLLECTING DATA), but the 80% rater agreement level criterion meant that this ability was not in the C profile. Each of the other eight abilities that were in the A profile but not in the C profile was assigned to at least one activity and sometimes up to four by seven raters. A slightly lower rater agreement criterion would have included them.

MOS 97E: Interrogator

An Interrogator conducts foreign language interrogations of prisoners of war, enemy deserters, and civilians from enemy areas to get information necessary for developing military intelligence and then prepares reports based on these interrogations. To assess the veracity of the information obtained, the Interrogator compares the information to other interrogation reports, captured documents, and intelligence reports. In another use of foreign language skills, an Interrogator translates foreign material into English and prepares summaries, extracts, or complete translations as appropriate. In addition to translating foreign language combat orders, directives, records, and messages to get intelligence information about the construction, operation, maintenance, employment, and characteristics of foreign equipment, an Interrogator translates material such as announcements, speeches, radio scripts, etc., into a foreign language for use with a non-English speaking population. The Interrogator may serve as an interpreter, translating foreign language conversations into English and English into a foreign language (Department of the Army, 1989, p. 758; Muckler, Seven, & Akman, 1990a, p. 35).

Figure 21 summarizes the judgements made by ten SMEs from MOS 97E about the abilities and skills needed for performance in this MOS. The figure lists the number of raters who selected each



	Ability No. & Name	YES	MN	SD
1	ORAL COMPREHENSION	10	6.7	0.5
2	WRITTEN COMPREHENSION	10	6.3	0.8
3	ORAL EXPRESSION	10	6.7	0.5
4	WRITTEN EXPRESSION	10	6.4	0.7
5	MEMORIZATION	9	5.8	1.1
6	PROBLEM SENSITIVITY	9	5.6	0.9
7	ORGINALITY	9	5.6	1.1
8	FLUENCY OF IDEAS	9	5.7	1.2
9	FLEXIBILITY OF CLOSURE	8	5.3	1.4
10	SELECTIVE ATTENTION	10	5.8	1.1
11	SPATIAL ORIENTATION	8	4.6	1.2
12	VISUALIZATION	5	5.7	1.6
13	INDUCTIVE REASONING	9	5.6	1.9
14	CATEGORY FLEXIBILITY	7	4.1	1.5
15	DEDUCTIVE REASONING	10	5.8	1.3
16	INFORMATION ORDERING	10	5.2	1.1
17	MATH REASONING	4	3.5	0.6
18	NUMBER FACILITY	6	4.2	1.8
19	TIME SHARING	8	4.9	1.5
20	SPEED OF CLOSURE	9	5.3	1.5
21	PERCEPTUAL SPD & ACCY	9	5.0	1.8
22	REACTION TIME	3	1.5	0.7
23	CHOICE REACTION TIME	1	2.0	
24	NEAR VISION	8	4.6	1.7
25	FAR VISION	5	3.4	1.5
26	NIGHT VISION	6	3.8	1.0
27	VISUAL COLOR DISC	7	3.5	1.3
28	PERIPHERAL VISION	5	3.4	2.5
29	DEPTH PERCEPTION	3	1.5	0.7
30	GLARE SENSITIVITY	4	2.4	1.3
31	GENERAL HEARING	10	4.8	1.7
32	AUDITORY ATTENTION	9	5.7	1.1
33	SOUND LOCALIZATION	3	3.3	0.7
34	CONTROL PRECISION	3	1.5	0.7
35	RATE CONTROL	1	1.0	
36	WRIST-FINGER SPEED	7	3.6	1.9
37	FINGER DEXTERITY	6	4.2	1.6
38	MANUAL DEXTERITY	3	3.7	2.3
39	ARM-HAND STEADINESS	3	2.5	2.1
40	MULTI-LIMB COORDINATION	3	2.5	2.1
41	EXTENT FLEXIBILITY	4	2.5	1.3
42	DYNAMIC FLEXIBILITY	1	1.0	
43	SPD OF LIMB MOVEMENT	1	1.0	
44	GROSS BODY EQUILIBRIUM	1	1.0	
45	GROSS BODY COORDINATN	3	2.2	1.3
46	STATIC STRENGTH	3	2.5	1.8
47	EXPLOSIVE STRENGTH	3	2.5	2.1
48	DYNAMIC STRENGTH	3	1.8	1.1
49	TRUNK STRENGTH	3	2.0	1.4
50	STAMINA	1	1.0	

Figure 21. SME judgments on abilities needed for [illegible]E.

ability, the mean weight placed on the ability and its standard deviation, and the profile of raters by abilities.

Examination of the figure immediately shows the importance of the communication abilities to this MOS--a finding which seems quite reasonable and expected. Also reasonable is the relative lack of importance placed on abilities in the psychomotor abilities and gross motor abilities areas. Considering the nature of the MOS, it is not surprising that GENERAL HEARING and AUDITORY ATTENTION are rated as very important. And among the cognitive skills, it is to be noted that SELECTIVE ATTENTION, DEDUCTIVE REASONING, and INFORMATION ORDERING stand out.

Table 25 lists the 20 abilities (of 50) that the SME raters found to be essential (based on the 80% cut-off level of rater agreement). Thus eight or more of the ten raters agreed that the 20 abilities listed in the table are essential for MOS 97E. Eight of the abilities were selected by all ten raters. These abilities divide into three classes: communications abilities, conceptual and reasoning abilities, and general hearing. The conceptual and reasoning demands center on three abilities, SELECTIVE ATTENTION, DEDUCTIVE REASONING, and INFORMATION ORDERING, that would seem to correspond very closely to good performance in the tasks associated with this MOS.

Figure 22 presents the abilities as seen in terms of the eight abilities clusters. The predominance of the communication abilities cluster is apparent, but there is also a reasonable balance between the remainder of the cognitive abilities and the perceptual abilities. However, whereas all of the abilities associated with communication have maximum ranking, in the remainder of the clusters individual abilities predominate. Again, as can be clearly shown in the figure, psychomotor abilities and gross motor abilities are not of importance in this MOS.

In a previous discussion in this report, the fact that an assessment of "knowledge" was missing for these MOSs was noted. This is particularly obvious in this MOS with respect to language. Qualification for this MOS requires proficiency in one or more foreign languages. So, this MOS rests at least on a solid knowledge of a foreign language. No other MOS in this CMF has this knowledge requirement. Here is a knowledge component of the job that would clearly interact with the need for communication abilities and skills. One may need ORAL EXPRESSION or WRITTEN COMPREHENSION in both English and some other language.

Table 26 presents a summary of the Part C data for MOS 97E. There are 20 abilities included in the Part C profile. Of these 20 abilities, 14 were represented in all eight intelligence production activities, and another in seven of the activities. The mean number of activities per ability is 6.3, an indication

Table 25

MOS 97E: Essential Abilities and Skills

Ability No. & Name		YES	MN	SD
1	ORAL COMPREHENSION	10	6.7	0.5
3	ORAL EXPRESSION	10	6.7	0.5
4	WRITTEN EXPRESSION	10	6.4	0.7
2	WRITTEN COMPREHENSION	10	6.3	0.8
10	SELECTIVE ATTENTION	10	5.8	1.1
15	DEDUCTIVE REASONING	10	5.8	1.3
16	INFORMATION ORDERING	10	5.2	1.1
31	GENERAL HEARING	10	4.8	1.7
5	MEMORIZATION	9	5.8	1.1
8	FLUENCY OF IDEAS	9	5.7	1.2
32	AUDITORY ATTENTION	9	5.7	1.1
7	ORGINALITY	9	5.6	1.1
6	PROBLEM SENSITIVITY	9	5.6	0.9
13	INDUCTIVE REASONING	9	5.6	1.9
20	SPEED OF CLOSURE	9	5.3	1.4
21	PERCEPTUAL SPD & ACCY	9	5.0	1.2
9	FLEXIBILITY OF CLOSURE	8	5.3	1.4
19	TIME SHARING	8	4.9	1.5
11	SPATIAL ORIENTATION	8	4.6	1.2
24	NEAR VISION	8	4.6	1.7

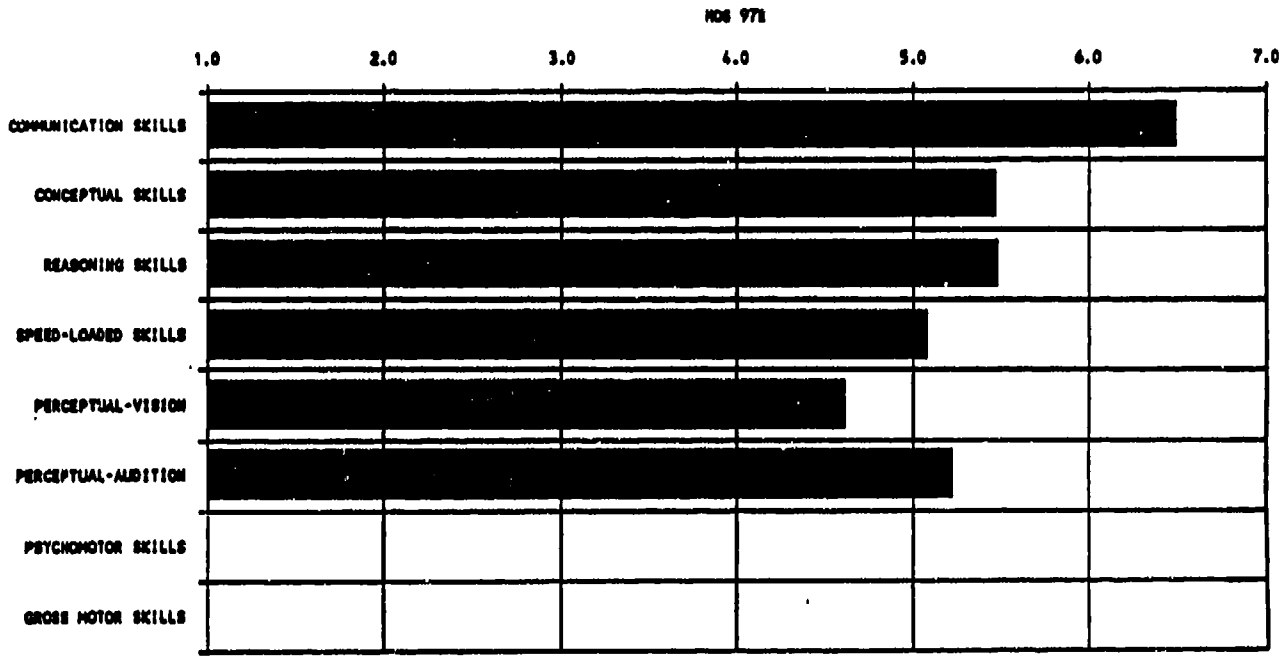


Figure 22. Cluster profiles for MOS 97E.

Table 26

Abilities Needed for Intelligence Production Activities: MOS 97E

ABILITY: Number/Name (Activities Requiring)		Amount of Ability by Activity*								Total Demand	Mean Demand
		P	S	C	M	A	I	P	D		
2. WRITTEN COMPREHENSION	(8)	5.9	5.8	5.8	4.8	4.9	4.5	5.2	5.7	42.6	5.3
4. WRITTEN EXPRESSION	(8)	5.0	4.5	5.2	6.0	5.2	4.1	5.9	6.0	41.9	5.2
1. ORAL COMPREHENSION	(8)	6.1	5.3	7.0	5.1	4.4	4.6	4.2	5.0	41.7	5.2
13. INDUCTIVE REASONING	(8)	5.5	4.6	5.8	5.2	5.6	5.6	5.3	4.0	41.6	5.2
5. MEMORIZATION	(8)	6.0	5.6	6.0	5.2	5.2	4.5	4.0	4.0	40.5	5.1
3. ORAL EXPRESSION	(8)	5.0	4.7	6.9	4.6	4.5	4.3	4.4	5.5	39.9	5.0
15. DEDUCTIVE REASONING	(8)	5.0	4.4	5.6	4.7	4.9	5.0	4.4	4.5	38.5	4.8
7. ORIGINALITY	(8)	5.2	4.9	6.2	4.0	4.3	4.3	4.5	4.5	37.9	4.7
8. FLUENCY OF IDEAS	(8)	5.0	4.1	5.5	3.8	3.7	5.0	4.7	4.8	36.6	4.6
6. PROBLEM SENSITIVITY	(8)	4.8	4.1	5.2	4.5	4.5	4.7	4.3	4.1	36.2	4.5
10. SELECTIVE ATTENTION	(8)	4.3	3.8	6.4	4.7	4.3	3.8	4.5	4.1	35.9	4.5
16. INFORMATION ORDERING	(8)	4.4	4.2	4.8	4.8	4.0	3.6	4.7	4.0	34.5	4.3
20. SPEED OF CLOSURE	(7)	4.8	4.6	6.1	5.0	4.6		4.0	3.5	32.6	4.7
32. AUDITORY ATTENTION	(8)	3.0	3.0	5.7	3.8	4.2	3.2	3.0	3.1	29.0	3.6
31. GENERAL HEARING	(8)	2.3	2.3	5.4	2.4	2.5	3.1	2.3	2.7	23.0	2.9
19. TIME SHARING	(3)	4.7	4.5	5.0						14.2	4.7
21. PERCEPTUAL SPEED & ACCURACY	(1)			5.6						5.6	5.6
24. NEAR VISION	(1)			5.0						5.0	5.0
11. SPATIAL ORIENTATION	(1)			4.9						4.0	4.9
18. NUMBER FACILITY	(1)			4.8						4.8	4.8
No. Abilities/Activity		16	16	20	15	15	14	15	15		
Total Amount/Activity		77.0	70.4	112.9	68.6	66.8	60.3	65.4	65.5		
Mean Amount/Activity		4.8	4.4	5.6	4.6	4.5	4.3	4.4	4.4		

*P = PLANNING
S = SETTING-UP OR PREPARING
C = COLLECTING DATA
M = MANAGING OR CATALOGING DATA
A = ANALYZING OR EXPLOITING DATA
I = INTERPRETING DATA
P = PREPARING OUTPUTS
D = DISSEMINATING INFORMATION

of considerable density in the use of the abilities and in contrast to the more activity-specific assignment of abilities in MOSs 96B, D, H, and R.

The total demand per ability ranges from 42.6 (WRITTEN COMPREHENSION) to 4.8 (NUMBER FACILITY), but 15 of the 20 abilities show total demands of 23 (GENERAL HEARING) and above. The top three abilities in terms of total demand ratings are communication skills, WRITTEN COMPREHENSION (42.6), WRITTEN EXPRESSION (41.9), and ORAL COMPREHENSION (41.7). INDUCTIVE REASONING (41.6) and MEMORIZATION (40.5) show total demand approximately equal to that of the three communication abilities; ORAL EXPRESSION, the fourth communication ability, is a close sixth in rank order at 39.9. The next seven abilities listed are reasoning and conceptual skills. The last of these, SPEED OF CLOSURE, is assigned to only seven activities (not Interpret), but the total demand for that ability (32.6) surpasses the demand for AUDITORY ATTENTION (29.0), even though that perceptual ability is listed in all eight activities.

The key to this reversal (ordinarily abilities used in a greater number of activities have higher total demand) lies in the mean demand levels. For SPEED OF CLOSURE it is 4.7; for AUDITORY ATTENTION it is only 3.6. Mean demand is over 4 (range 4.3 to 5.6) for 18 of the 20 abilities. The remaining two are auditory abilities, AUDITORY ATTENTION (3.6) and GENERAL HEARING (2.9). Only in the COLLECTING DATA activity does the amount of these abilities needed rise above 5. In the other activities, the need is present but at a lower level of demand.

The dense use of abilities by MOS 97E is seen in the number of abilities used in each activity. All eight activities use the same 14 of the first 15 listed abilities (no SPEED OF CLOSURE for Interpret). The lowest number is 14 (INTERPRETING DATA) and one activity, COLLECTING DATA, uses all 20 abilities in the profile. COLLECTING DATA also shows the highest total amount of activity (112.9) and has the highest mean amount (5.6). In this activity, one ability (ORAL COMPREHENSION) is rated 7, the very top of the scale, and ORAL EXPRESSION received 6.9. Since these are means of the judgements of the raters, they represent consensus that intelligence collection places very high demands on these abilities in this MOS.

The other seven activities show total amounts of ability needed that range from 77.0 (PLANNING) down to 60.3 (INTERPRETING DATA) and mean amounts from 4.8 (PLANNING) to 4.3 (INTERPRETING DATA), but the differences between them are small compared to the differences between the highest of the seven (PLANNING) and COLLECTING DATA. Although all eight activities demand considerable amounts of a number of abilities, it is the COLLECTING DATA activity that stands out as the most demanding.

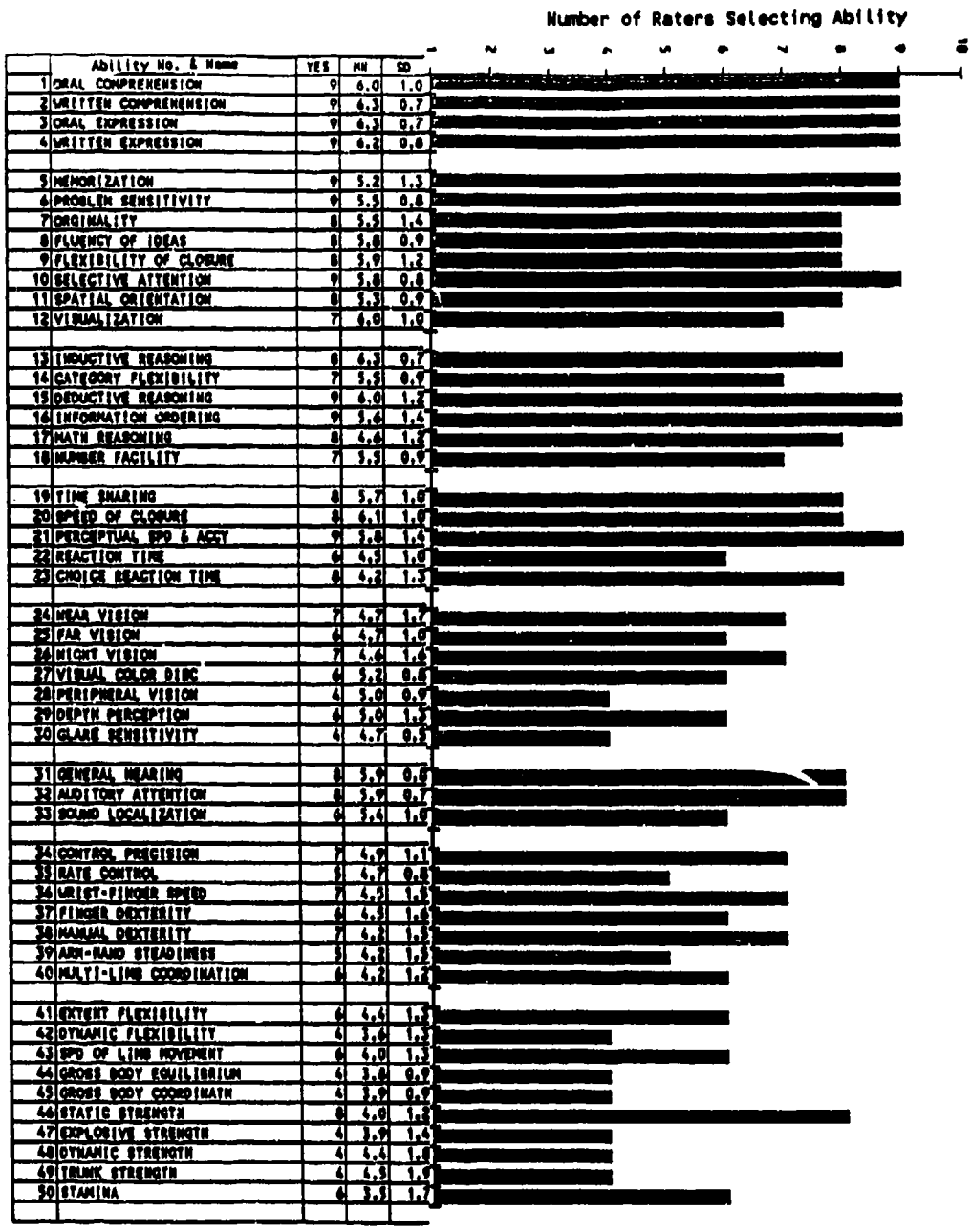
Just as there are 20 abilities in the C profile of MOS 97E, so there are 20 abilities in the A profile. The profiles have 19 abilities in common, and each has an ability not in the other. NUMBER FACILITY, the last listed ability in the C data summary, was only selected by six of the 10 raters in Part A so it was not in the A profile. FLEXIBILITY OF CLOSURE was in the A profile but not in the C list. Although for each of the eight activities some raters selected this ability (with amount ranging from 4.1 to 5.7), it did not meet the 80% criterion and so was not part of the C profile.

MOS 97G: Counter-Signals Intelligence Specialist

The Counter-Signals Intelligence Specialist collects and analyzes data on communications and electronic activity, provides advice and assistance on electronic security and cryptosystems, and reviews and reports on counter-signals intelligence doctrine and activities. The Specialist prepares and executes deployment plans to support counter-signals intelligence operations. At the lower skill levels, the Counter-Signals Intelligence Specialist operates communication equipment and maintains communications and communications security and monitoring equipment. The Specialist selects, erects, and orients tactical antennas; selects and uses commercial, battery, and generator power; monitors and records communications and produces transcripts; and prepares basic reports on counter-signal intelligence activities. At higher skill levels, the Counter-Signals Intelligence Specialist prepares counter-signal intelligence monitoring plans, plans and supervises electronic support activity, provides technical guidance to lower grade personnel and advice on the management of personnel equipment resources to upper echelons, and plans and executes counter-signals intelligence missions (Department of the Army, 1989, page 760; Muckler, Seven, & Akman, 1990a, p. 36).

Figure 23 shows the judgements made by nine SMEs from MOS 97G as to the abilities and skills necessary for performance of the tasks in this MOS. In the figure, the 50 abilities are listed in order of presentation to the rater with the number of raters selecting each ability, the mean importance and standard deviation, and the profile of raters' level of agreement by the 50 abilities.

Visual examination of the figure shows how important communication abilities are judged for this MOS. Further, all of the cognitive abilities (abilities 5 through 23) have considerably high ratings. The tasks appear to require many abilities. Of particular interest are those associated with gross motor abilities (abilities 41 through 50) which reflect in part the need to deal with physically rather substantial pieces of equipment. Also appropriate is the high importance given to GENERAL HEARING and AUDITORY ATTENTION since using communication equipment is fundamental to task performance.



	Ability No. & Name	YES	MN	SD
1	ORAL COMPREHENSION	9	6.0	1.0
2	WRITTEN COMPREHENSION	9	6.3	0.7
3	ORAL EXPRESSION	9	6.3	0.7
4	WRITTEN EXPRESSION	9	6.2	0.8
5	MEMORIZATION	9	5.2	1.3
6	PROBLEM SENSITIVITY	9	5.5	0.8
7	ORIGINALITY	8	5.5	1.4
8	FLUENCY OF IDEAS	8	5.8	0.9
9	FLEXIBILITY OF CLOSURE	8	5.9	1.2
10	SELECTIVE ATTENTION	9	5.8	0.8
11	SPATIAL ORIENTATION	8	5.5	0.9
12	VISUALIZATION	7	6.0	1.0
13	INDUCTIVE REASONING	8	6.3	0.7
14	CATEGORY FLEXIBILITY	7	5.5	0.9
15	DEDUCTIVE REASONING	9	6.0	1.2
16	INFORMATION ORDERING	9	5.6	1.4
17	MATH REASONING	8	4.6	1.8
18	NUMBER FACILITY	7	5.5	0.9
19	TIME SHARING	8	5.7	1.0
20	SPEED OF CLOSURE	8	6.1	1.0
21	PERCEPTUAL SPD & ACCY	9	5.8	1.4
22	REACTION TIME	6	4.5	1.0
23	CHOICE REACTION TIME	8	4.8	1.3
24	NEAR VISION	7	4.7	1.7
25	FAR VISION	6	4.7	1.0
26	NIGHT VISION	7	4.6	1.6
27	VISUAL COLOR DISC	6	5.2	0.8
28	PERIPHERAL VISION	4	5.0	0.9
29	DEPTH PERCEPTION	6	5.0	1.3
30	GLARE SENSITIVITY	4	4.7	0.5
31	GENERAL HEARING	8	5.9	0.6
32	AUDITORY ATTENTION	8	5.9	0.7
33	SOUND LOCALIZATION	6	5.4	1.0
34	CONTROL PRECISION	7	4.9	1.1
35	RATE CONTROL	5	4.7	0.8
36	WRIST-FINGER SPEED	7	4.8	1.5
37	FINGER DEXTERITY	6	4.5	1.6
38	MANUAL DEXTERITY	7	4.8	1.5
39	ARM-HAND STEADINESS	5	4.2	1.3
40	MULTI-LIMB COORDINATION	6	4.8	1.6
41	EXTENT FLEXIBILITY	6	4.6	1.5
42	DYNAMIC FLEXIBILITY	4	3.8	1.3
43	SPD OF LIMB MOVEMENT	6	4.0	1.3
44	GROSS BODY EQUILIBRIUM	4	3.8	0.9
45	GROSS BODY COORDINATN	4	3.9	0.9
46	STATIC STRENGTH	8	4.0	1.8
47	EXPLOSIVE STRENGTH	4	3.9	1.4
48	DYNAMIC STRENGTH	4	4.4	1.8
49	TRUNK STRENGTH	4	4.5	1.9
50	STAMINA	6	5.5	1.7

Figure 23. SME judgments on abilities needed for MOS 97G.

Table 27 shows the essential abilities and skills for MOS 97G as defined by the criterion of 80% of the raters agreeing on the need for the ability. Some 22 abilities are shown in the table. They are strongly concentrated in the communications, conceptual, reasoning, and speed-loaded abilities areas. Indeed, of the 22 abilities, 19 are in these cognitive domains; the remaining three are GENERAL HEARING, AUDITORY LOCALIZATION, and STATIC STRENGTH. The cognitive demands are judged so strong for this MOS that only VISUALIZATION, CATEGORY FLEXIBILITY, NUMBER FACILITY, and REACTION TIME are missing.

Figure 24 assembles the abilities into the eight clusters. The importance of communication, conceptual, reasoning, and speed-loaded abilities is apparent as is the need for perceptual-audition abilities. The importance of gross motor abilities rests heavily on STATIC STRENGTH. The relative unimportance of perceptual-vision and psychomotor abilities is reasonable, but one should also note from the figure that in both categories all abilities in each receive moderate levels of skill ratings. There is a requirement for both but neither is very strong.

The MOS illustrates the kind of job and tasks where a wide range of demands may be made on the incumbents. Both cognitive and equipment requirements are present even though it is clear that the cognitive demands are judged as far more important than those associated with the equipment.

Part C data for MOS 97G are summarized in Table 28. The C profile includes 21 abilities and 19 of them are assigned to all eight activities. Another (AUDITORY ATTENTION) is assigned to seven activities and the remaining ability, CHOICE REACTION TIME, is assigned to four abilities. This dense use of abilities translates into a mean number of activities per ability of 7.8, a very high number in that 8 is the maximum possible, and the highest of the entire CMF.

Total demand per ability ranges from 47.4 (WRITTEN COMPREHENSION) down to 15.8 (CHOICE REACTION TIME). Since that latter ability was assigned to only half of the activities, its smaller total is not surprising. Without it, the range of total demand is cut in half and goes down only to 32.3 (SPATIAL ORIENTATION). The 15 abilities judged to have the highest total load demand represent a mix of communication, reasoning, speed-loaded, and conceptual skills with no strong emphasis on any one of these clusters of abilities. All four communication abilities fall within the first six abilities listed, but that is not unusual for this CMF. Seven of the eight conceptual abilities are in the profile, but the representation of this cluster is only slightly greater than in the other MOSs. Perhaps more notable is that four of the five speed-loaded abilities are included in the profile, three of them included in all eight activities. Time pressure seems a part of each activity for

Table 27

MOS 97G: Essential Abilities and Skills

Ability No. & Name		YES	MN	SD
2	WRITTEN COMPREHENSION	9	6.3	0.7
3	ORAL EXPRESSION	9	6.3	0.7
4	WRITTEN EXPRESSION	9	6.2	0.8
15	DEDUCTIVE REASONING	9	6.0	1.2
1	ORAL COMPREHENSION	9	6.0	1.0
21	PERCEPTUAL SPD & ACCY	9	5.8	1.4
10	SELECTIVE ATTENTION	9	5.8	0.8
16	INFORMATION ORDERING	9	5.6	1.4
6	PROBLEM SENSITIVITY	9	5.5	0.8
5	MEMORIZATION	9	5.2	1.3
13	INDUCTIVE REASONING	8	6.3	0.7
20	SPEED OF CLOSURE	8	6.1	1.0
31	GENERAL HEARING	8	5.9	0.8
32	AUDITORY ATTENTION	8	5.9	0.7
9	FLEXIBILITY OF CLOSURE	8	5.9	1.2
8	FLUENCY OF IDEAS	8	5.8	0.9
19	TIME SHARING	8	5.7	1.0
7	ORGINALITY	8	5.5	1.4
11	SPATIAL ORIENTATION	8	5.3	0.9
17	MATH REASONING	8	4.6	1.2
23	CHOICE REACTION TIME	8	4.2	1.3
46	STATIC STRENGTH	8	4.0	1.2

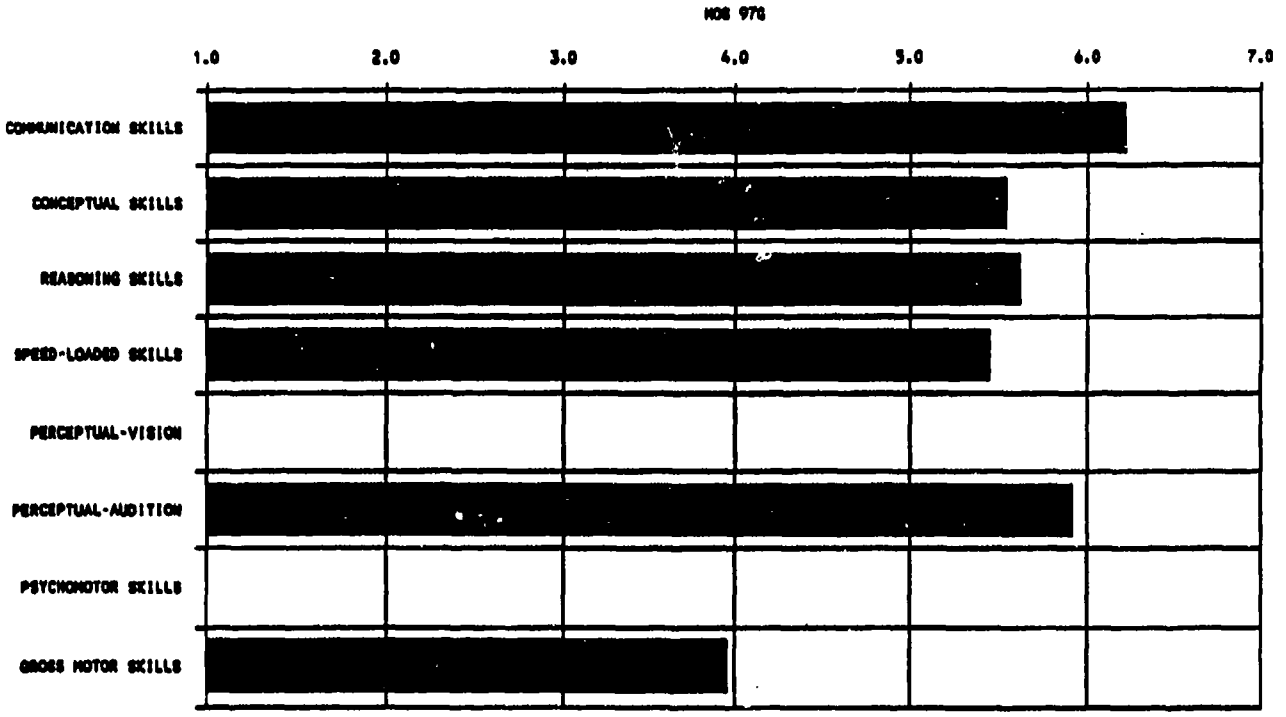


Figure 24. Cluster profile for MOS 97E.

Table 28

Abilities Needed for Intelligence Production Activities: MOS 97G

ABILITY: Number/Name (Activities Requiring)	Amount of Ability by Activity*								Total Demand	Mean Demand
	P	S	C	M	A	I	P	D		
2. WRITTEN COMPREHENSION (8)	5.7	5.3	6.1	6.1	5.9	6.0	6.6	5.7	47.4	5.9
13. INDUCTIVE REASONING (8)	5.3	5.0	6.5	6.1	6.4	6.2	5.7	4.9	46.1	5.8
4. WRITTEN EXPRESSION (8)	5.9	5.2	5.8	5.4	6.1	5.7	6.4	5.2	45.7	5.7
20. SPEED OF CLOSURE (8)	4.9	4.9	6.3	6.0	6.5	6.1	5.3	4.8	44.8	5.6
3. ORAL EXPRESSION (8)	6.0	6.0	5.0	5.3	5.7	4.5	5.5	6.7	44.7	5.6
1. ORAL COMPREHENSION (8)	5.3	4.8	5.8	5.3	5.9	5.9	6.1	5.4	44.5	5.6
19. TIME SHARING (8)	5.4	5.3	6.0	5.3	5.9	6.0	5.4	4.9	44.2	5.5
10. SELECTIVE ATTENTION (8)	5.1	5.4	6.1	5.4	6.3	6.2	5.0	4.3	43.8	5.5
15. DEDUCTIVE REASONING (8)	5.8	5.3	5.6	5.4	5.8	5.5	5.5	4.8	43.7	5.5
9. FLEXIBILITY OF CLOSURE (8)	4.8	4.6	5.8	5.1	6.5	6.6	5.2	5.0	43.6	5.4
6. PROBLEM SENSITIVITY (8)	5.3	5.4	5.3	5.4	6.0	5.5	5.1	4.7	42.7	5.3
7. ORIGINALITY (8)	5.4	5.4	5.6	4.9	5.5	5.1	5.1	4.8	41.8	5.2
16. INFORMATION ORDERING (8)	4.8	4.7	5.1	5.2	5.0	4.9	5.1	4.8	39.6	5.0
8. FLUENCY OF IDEAS (8)	5.1	5.4	4.9	4.4	5.5	5.5	4.5	4.0	39.3	4.9
21. PERCEPTUAL SPEED & ACCURACY (8)	4.2	4.4	5.1	4.5	5.6	5.4	4.9	4.3	38.4	4.8
31. GENERAL HEARING (8)	3.8	3.9	5.9	4.7	5.9	5.5	4.2	4.0	37.9	4.7
32. AUDITORY ATTENTION (7)		4.4	6.1	5.7	6.1	6.1	4.8	4.3	37.5	5.4
5. MEMORIZATION (8)	5.3	4.4	4.5	5.2	4.0	4.7	4.1	4.0	36.2	4.5
17. MATHEMATICAL REASONING (8)	4.4	4.3	5.1	4.4	4.9	4.6	4.2	3.8	35.7	4.5
11. SPATIAL ORIENTATION (8)	3.9	4.9	3.9	3.6	4.9	4.7	3.2	3.2	32.3	4.0
23. CHOICE REACTION TIME (4)		3.2	4.4	4.4	3.8				15.8	4.0
No. Abilities/Activity	19	21	21	21	22	20	20	20		
Total Amount/Activity	96.4	102.2	114.9	107.8	118.2	110.7	101.9	93.6		
Mean Amount/Activity	5.1	4.9	5.5	5.1	5.6	5.5	5.1	4.7		

*P = PLANNING
S = SETTING-UP OR PREPARING
C = COLLECTING DATA
M = MANAGING OR CATALOGING DATA
A = ANALYZING OR EXPLOITING DATA
I = INTERPRETING DATA
P = PREPARING OUTPUTS
D = DISSEMINATING INFORMATION

this MOS. In summary, with the exception of two auditory skills, the MOS 97G profile is drawn from abilities in the first four clusters; no psychomotor or gross motor skills are included.

Mean demand on the 21 abilities in the profile varies from 5.9 for WRITTEN COMPREHENSION (which also has the highest total demand) to 4.0 for both SPATIAL ORIENTATION and CHOICE REACTION TIME. Fourteen of the 21 have mean demands of 5.0 or greater. The ability demand is spread across a large number of abilities and is sustained from one activity to another.

Most of the abilities are used in all of the activities and that fact is shown in the totals for number of abilities needed per activity; the range is from 19 to 21. Four activities (SETTING-UP OR PREPARING, COLLECTING DATA, MANAGING OR CATALOGING DATA, and ANALYZING OR EXPLOITING DATA) use all 21 abilities. INTERPRETING DATA, PREPARING OUTPUTS, and DISSEMINATING INFORMATION use all but CHOICE REACTION TIME, and that ability plus AUDITORY ATTENTION is not used in PLANNING.

Differences in total amount of ability needed and in mean amount of ability for an activity show that DISSEMINATING INFORMATION is lowest (93.6 and 4.7) and ANALYZING OR EXPLOITING DATA the highest (118.2 and 5.6). The differences are not great, and both measures indicate a sustained and balanced demand for MOS 97E across activities and across abilities.

The Part A profile includes all 21 abilities in the Part C profile and has one additional ability not included in the Part C profile: STATIC STRENGTH. (Only six of the nine raters assigned STATIC STRENGTH to activities, and they assigned it to all eight activities.) With this single exception, the abilities in the A and C profiles for MOS 97G are the same.

An Abilities and Skills Profile of 96 CMF

To this point, the discussion has focused on the individual MOSs, and the preceding chapter presented abilities and skills data on each of the seven MOSs in 96 CMF. It is now possible to consider combining some of these data and to make some preliminary comments about abilities and skills across the entire CMF.

One question that might be asked, "Is there a common core of abilities and skills that characterize this CMF?" At least two ways can be used to estimate answers to that question. Table 29 lists those two, based on two sets of criteria.

The first estimate in the table is drawn from the individual MOS data and is based on the 80% cut-off criterion or rater agreement used in each MOS analysis. The ten abilities listed in the first column of the table are the ones that were common to each of the seven individual MOS profiles. The second column of the table presents another estimate of the abilities common to this CMF, an estimate based on summarizing the number of times each ability was selected within an MOS, adding across all seven MOSs, and then applying a 90% criterion as a cut-off. The abilities listed in the second column are those selected by 90% of the raters, regardless of MOS.

Table 30 presents the data from which the second column was generated. Applying a 90% cut-off to the final or summary column in that table means that any ability rated above 58.5 appears on the list of abilities and those rated lower do not. In Table 30, the first cell of the table shows that on the first ability (ORAL COMPREHENSION) nine raters from MOS 96B picked that ability. Following across the row, the total number of times ORAL COMPREHENSION was selected was 64. This means that all but one of the raters (N = 65) picked this ability. Thus, the final column is an indication of how many times the ability was selected. As may be seen the range runs from 28 to 64. While one should be very careful about adding numbers across these groups, the aggregates do seem to give meaningful findings if interpreted carefully. The abilities listed under the 90% all-raters criterion are very similar to those found by the 80% individual MOS criterion.

The abilities described suggest that 96 CMF is a job family where communication, cognitive, and reasoning skills are essential. Thus, 10 or 11 abilities can be drawn out as a sort of core set of abilities for 96 CMF.

If the 96 CMF were to be represented by the abilities needed in any of the individual MOSs (rather than only those abilities

Table 29

Estimated Abilities Common to 96 CMF

Based on 80% individual MOS	Based on 90% All Raters
1. ORAL COMPREHENSION	1. ORAL COMPREHENSION
2. WRITTEN COMPREHENSION	2. WRITTEN COMPREHENSION
3. ORAL EXPRESSION	3. ORAL EXPRESSION
	4. WRITTEN EXPRESSION
5. MEMORIZATION	5. MEMORIZATION
6. PROBLEM SENSITIVITY	6. PROBLEM SENSITIVITY
10. SELECTIVE ATTENTION	10. SELECTIVE ATTENTION
11. SPATIAL ORIENTATION	11. SPATIAL ORIENTATION
15. DEDUCTIVE REASONING	15. DEDUCTIVE REASONING
16. INFORMATION ORDERING	16. INFORMATION ORDERING
19. TIME SHARING	

Table 30

Summary Ratings by Ability and MOS

ABILITY	MOS							Σ
	96B	96D	96H	96R	97B	97E	97G	
1	9	10	7	9	10	10	9	64
2	9	10	7	9	10	10	9	64
3	9	9	7	9	10	10	9	63
4	9	10	7	7	10	10	9	62
5	9	9	8	9	10	9	9	63
6	9	8	8	9	9	9	9	61
7	8	5	6	8	9	9	8	53
8	9	3	7	8	9	9	8	53
9	8	7	8	9	10	8	8	58
10	8	9	8	9	10	10	9	63
11	9	9	8	9	9	8	8	60
12	9	7	6	9	8	5	7	51
13	8	8	7	8	8	9	8	56
14	6	7	4	8	4	7	7	43
15	9	9	7	9	10	10	9	63
16	8	9	7	8	10	10	9	61
17	7	9	8	9	3	4	8	48
18	8	10	8	9	4	6	7	52
19	8	8	8	9	9	8	8	58
20	8	6	7	9	9	9	8	56
21	7	10	7	9	7	9	9	58
22	2	5	6	9	3	2	6	33
23	4	4	7	8	6	1	8	38
24	6	10	8	9	8	8	7	56
25	6	9	8	9	7	5	6	50
26	6	8	8	9	8	6	7	52
27	7	8	8	7	6	7	6	49
28	5	6	8	9	6	5	4	43
29	6	10	8	9	7	2	6	48
30	3	7	8	8	5	4	4	39
31	7	2	8	9	9	10	8	53
32	6	2	7	9	9	9	8	50
33	4	2	6	8	5	2	6	33
34	7	7	8	9	3	2	7	43
35	2	3	7	9	2	1	5	29
36	5	4	5	9	7	7	7	44
37	8	3	7	9	9	6	6	48
38	6	4	6	9	7	3	7	42
39	6	5	7	8	3	2	5	36
40	5	5	7	8	6	2	6	39
41	6	3	7	7	3	4	6	36
42	4	2	7	7	3	1	4	28
43	4	2	5	9	1	1	6	28
44	4	3	6	8	3	3	4	31
45	6	2	5	7	3	2	4	29
46	7	3	7	9	2	2	8	38
47	3	3	6	8	2	2	4	28
48	4	3	6	6	3	2	4	28
49	4	3	6	7	2	2	4	28
50	6	3	6	8	4	1	6	34

included in each and every MOS), the list would expand to encompass 47 of the 50 abilities. Only GROSS BODY COORDINATION, DYNAMIC STRENGTH, and TRUCK STRENGTH would be missing since only those three did not appear as essential in one or another MOS in the 96 CMF. The inclusiveness of such a combined list of abilities is largely but not totally due to the extensive use of abilities in MOS 96R, which included 43 of the 50 abilities.

Just as a 90% rater agreement criterion was applied to the summary column of the table to generate the list of abilities appearing in the earlier table, the more common 80% criterion can be applied to these same data to generate yet another composite profile of the 96 CMF. The result is shown in Table 31 which is a listing of abilities selected by 80% of the raters for the entire 96 CMF. The same general pattern occurs with heavy emphasis on communication and cognitive abilities. However, at this level of agreement, three additional abilities surface from vision and audition: NEAR VISION, NIGHT VISION, and GENERAL HEARING. One may note the absence of any abilities from the psychomotor and gross motor abilities areas. This absence does not mean that for some of the MOSs in this CMF gross motor abilities are not important (cf., MOS 96H and MOS 97G). What it does mean is that the demands of most of the 96 CMF MOSs for psychomotor and gross motor abilities are far less than for communication and cognitive abilities.

A summary profile for the entire 96 CMF can be created, and it is shown in Figure 25. The percent data are the percent of total possible rater agreement on various abilities for each of the eight clusters used in this report. They show, for example, that raters agreed 97% of all possible times on the inclusion of abilities associated with communication but only 47% of the time for abilities associated with gross motor abilities. The figure estimates the relative importance of the clusters for job performance in 96 CMF.

As has been said before for all of the individual MOSs, the jobs in 96 CMF are rich in content and demanding on their practitioners. While perhaps not so physically demanding as some MOSs (e.g., 14B in the artillery), they are demanding across the entire spectrum of abilities described here. The strong emergence of the need for communication abilities is not surprising. It reflects the fact that the paramount need in military intelligence is the communication of the intelligence data that has been generated. It is evident that the 60 SME raters in this study are aware of the relative need and importance of communication.

But, it is also evident from the heavy requirements in the conceptual, reasoning, and speed-loaded abilities areas that the

Table 31

Abilities Selected by 80% of 96 CMF Raters

1.	ORAL COMPREHENSION
2.	WRITTEN COMPREHENSION
3.	ORAL EXPRESSION
4.	WRITTEN EXPRESSION
5.	MEMORIZATION
6.	PROBLEM SENSITIVITY
7.	ORIGINALITY
8.	FLUENCY OF IDEAS
9.	FLEXIBILITY OF CLOSURE
10.	SELECTIVE ATTENTION
11.	SPATIAL ORIENTATION
13.	INDUCTIVE REASONING
15.	DEDUCTIVE REASONING
16.	INFORMATION ORDERING
18.	NUMBER FACILITY
19.	TIME SHARING
20.	SPEED OF CLOSURE
21.	PERCEPTUAL SPEED AND ACCURACY
24.	NEAR VISION
26.	NIGHT VISION
31.	GENERAL HEARING

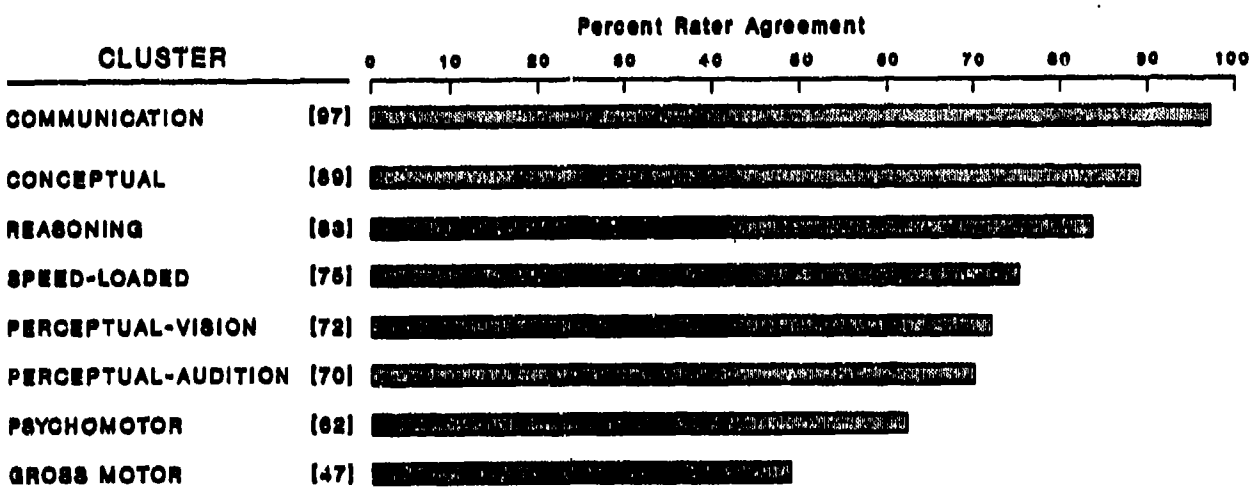


Figure 25. Cluster profile for 96 CMF.

generation of timely intelligence data presents a heavy intellectual and cognitive demand. The emphasis on speed-loaded abilities stresses the fact that military intelligence must be collected rapidly as well as accurately.

A major difference among these MOSs is the presence or absence of equipment. Some MOSs have little important equipment (e.g., MOS 97E), and other MOSs have very substantial and major equipment (e.g., MOS 96H, MOS 96R, and MOS 97G). What has been interesting in these data is not so much the differences due to equipment among what would appear to be very separate jobs but rather the extensive similarities in abilities and skills needed to perform all the jobs. Equipment will bring other demands--usually in the psychomotor or gross motor ability areas. But, in the communication and cognitive areas, the profiles and the demands are very similar.

The importance of these data for future use and applications can be shown in two examples: selection and training. Selection systems are normally designed to the fundamental abilities required for the task, job, or job family. The results here showing the core estimated abilities common to 96 CMF could be used as the foundation for a test battery. Appropriate tests are available for each of the 10 abilities. Or, at a higher level, one could construct a three-test battery for communication, conceptual, and reasoning abilities. U.S. Army selection dimensions, composites, and criteria are constantly undergoing examination and change where necessary, and abilities data drawn directly from the job family (such as derived here) could be very helpful in improving selection performance.

Training is provided for all military jobs, and one can distinguish between specific task training and generic training of a more fundamental nature. These data suggest that generic training in all forms of communication could be of considerable value to all members of the 96 CMF. Communications training is a well-established area, and many courses are available. Based on these data for 96 CMF, a test of the effectiveness of communications training could result in very cost-effective training for the entire career management field. A good test, for example, would compare generic communication training with communications training modules embedded in normal training courses.

Abilities Selections and Rater Agreement Level

In the second chapter of this report, the effect of varying level of rater agreement on abilities selection was discussed. To use MARS data, some level of rater agreement has to be chosen; normally, the cut-off score is 80% of the raters in agreement.

However, all of the results for each agreement level can be displayed to give some indication of the different kinds of abilities profiles that are possible.

Figure 26 shows how the number of abilities selected is affected by varying rater agreement level for all seven MOSs in the 96 CMF. The figure illustrates clearly the difference in abilities selected among the MOSs for this CMF. At the opposite end, agreement on abilities not necessary for the MOS is tabulated. The figure shows, for example, that agreement on unnecessary abilities does not exist at the 100% rater agreement level. Raters in this study appeared to be reluctant to rule out any ability.

Abilities and Intelligence Activities

In a previous chapter, eight fundamental intelligence production activities were defined:

1. PLANNING
2. SETTING-UP OR PREPARING
3. COLLECTING DATA
4. MANAGING OR CATALOGING DATA
5. ANALYZING OR EXPLOITING DATA
6. INTERPRETING DATA
7. PREPARING OUTPUTS
8. DISSEMINATING INFORMATION.

One immediate question is: what abilities were assigned to each of the eight activities and what was the resultant importance of each activity? Table 32 provides an initial and partial answer to that question. The data were formed by counting all uses of each ability of every rater in all eight activities. Each cell, therefore, is the total number of uses of abilities by each rater appropriate to that cell by MOS.

The marginal means by columns give an estimate of the degree to which abilities were assigned to each of the eight activities. The column means suggest a fairly even distribution for the eight activities with perhaps some emphasis on the first three (PLANNING, SETTING-UP OR PREPARING, and COLLECTING DATA). The row means reflect the differential number of abilities that raters felt were needed across all intelligence activities.

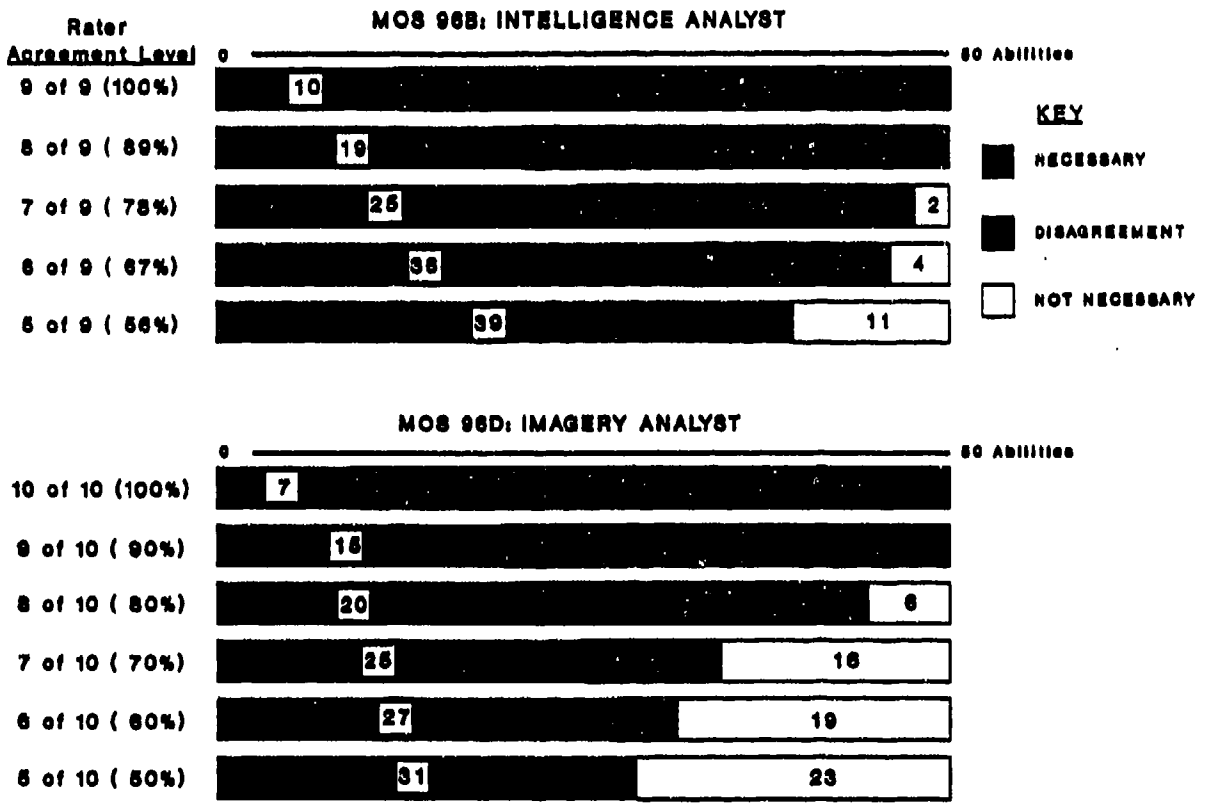


Figure 26. Ability selections as a function of rater agreement level.

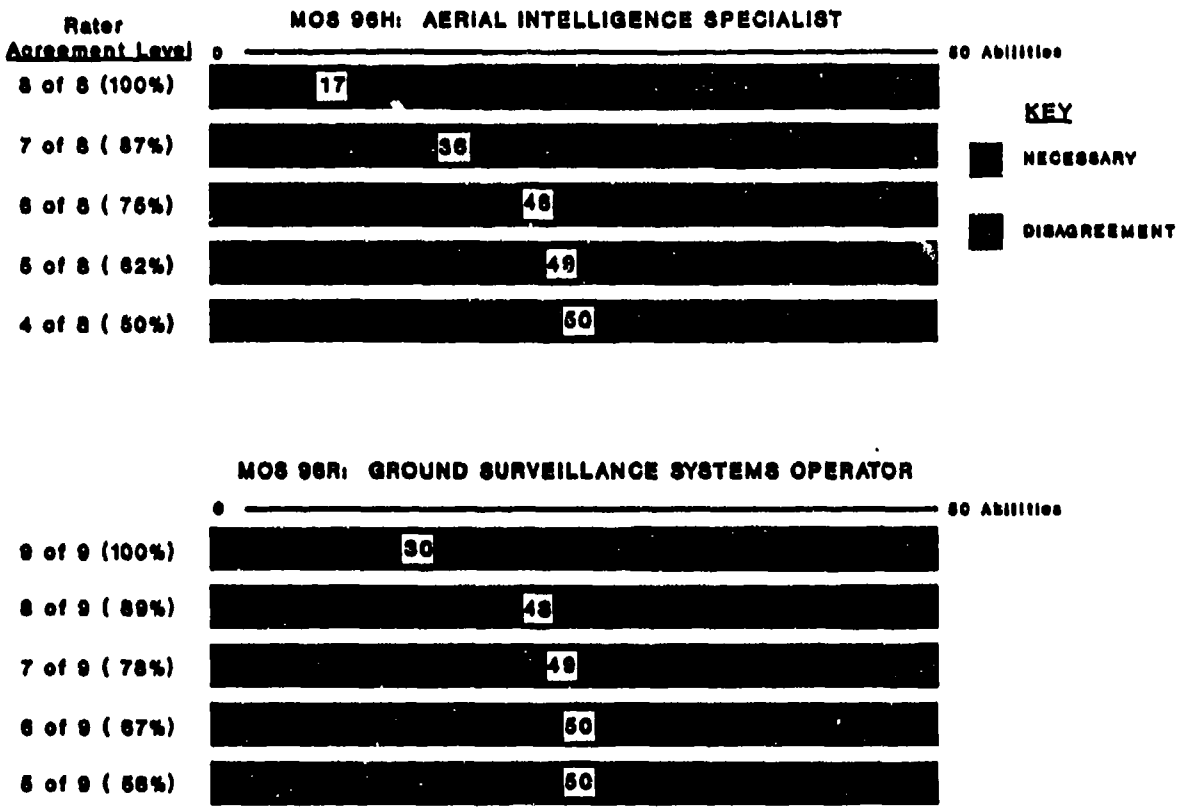


Figure 26. Ability selections as a function of rater agreement level (continued).

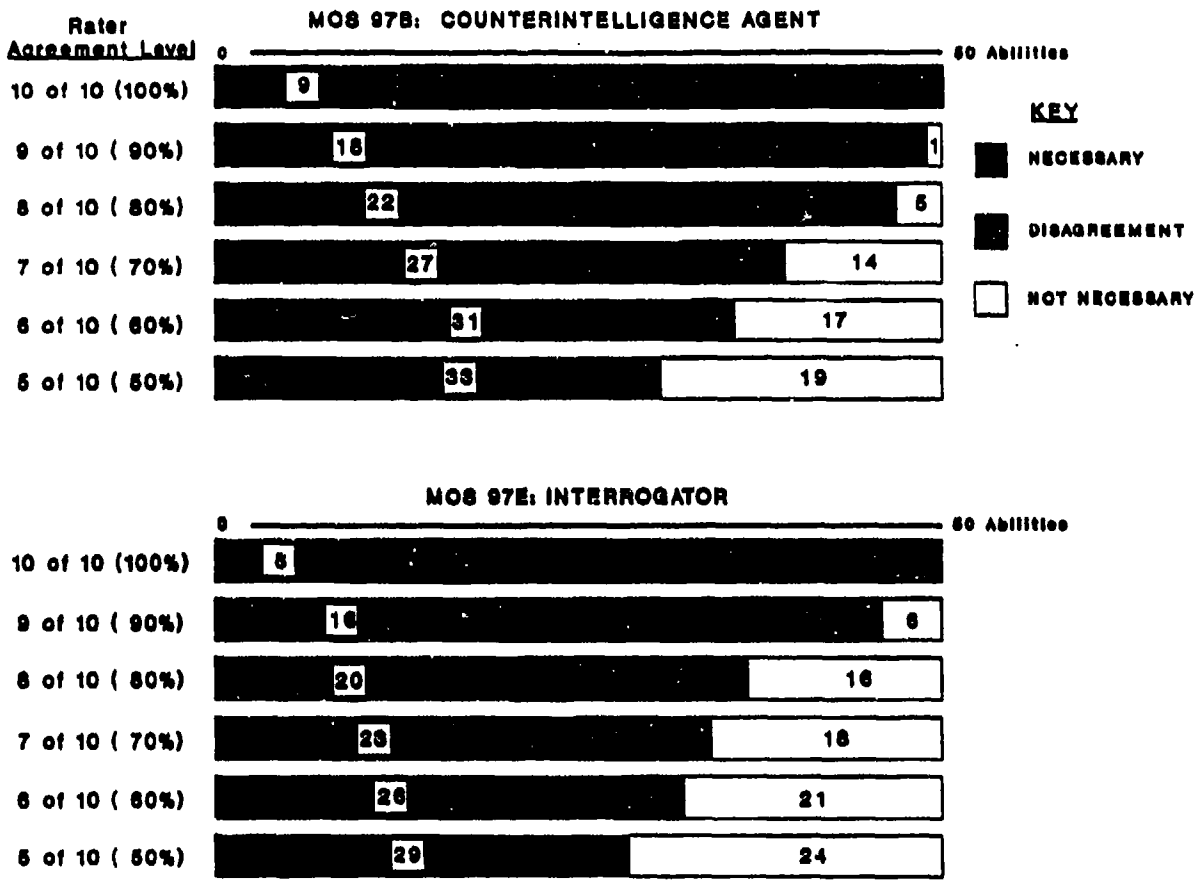


Figure 26. Ability selections as a function of rater agreement level (continued).

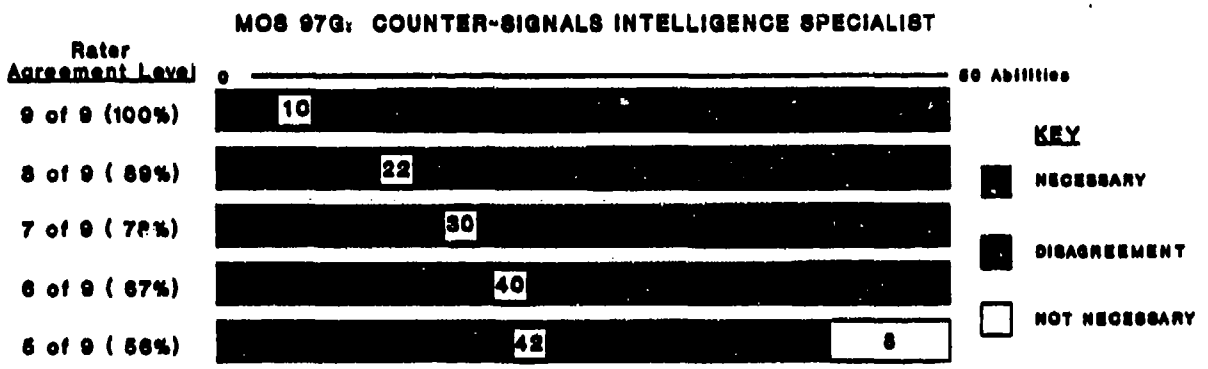


Figure 26. Ability selections as a function of rater agreement level (continued).

Table 32

Abilities Related to Intelligence Activities by MOS

MOS	Intelligence Activities* - Abilities Used In								MEAN**
	P	S	C	M	A	I	P	D	
96B	157	172	145	150	158	142	146	139	16.8
96D	165	161	164	162	212	208	158	157	17.3
96H	198	219	271	42	8	16	14	78	13.2
96R	275	353	326	273	275	291	286	284	32.8
97B	214	190	228	205	224	236	201	188	21.1
97E	242	242	244	241	241	240	241	241	26.8
97G	326	335	333	332	331	310	307	304	35.8
MEAN (N=65)	24.6	26.1	26.7	22.0	22.6	22.5	21.1	21.7	23.4

*P = PLANNING
S = SETTING-UP OR PREPARING
C = COLLECTING DATA
M = MANAGING OR CATALOGING DATA
A = ANALYZING OR EXPLOITING DATA
I = INTERPRETING DATA
P = PREPARING OUTPUTS
D = DISSEMINATING INFORMATION

**Mean = total of row divided by (number of activities times the number of raters)

There are marked differences among the MOSs. Most noticeable is that of MOS 96H where there are high requirements for the abilities in the first three categories but very little in the remaining five. Only at the end (that is, for DISSEMINATING INFORMATION) is there an increase in need for abilities. It might also be of interest to see what activity category is ranked most frequently for each MOS:

96B = SETTING-UP OR PREPARING
96D = ANALYZING OR EXPLOITING DATA
96H = COLLECTING DATA
96R = SETTING-UP OR PREPARING
97B = INTERPRETING DATA
97E = COLLECTING DATA
97G = SETTING-UP OR PREPARING

In short, the heaviest demands seem to be made with respect to SETTING-UP OR PREPARING and to COLLECTING DATA.

With respect to differences among MOSs (or the marginal row means), the range of means of abilities used is from 16.8 (MOS 96B) to 35.8 (MOS 97G). These means may provide a gross indication of differential difficulty among the MOSs or relative job difficulty or an intelligence load index; another way of measuring that kind of dimension will be discussed in the next section.

This initial measure of the use of ability dimensions in intelligence activities suggests that the heaviest load is on the input side -- PLANNING, PREPARING OUTPUTS, and COLLECTING DATA. If that is so, then re-design attempts to unburden the MI specialist in their MOSs and the respective tasks might best come in that side of the total process.

Relative Job Difficulty

Data from the 96 CMF MOS have indicated that profiles of each job can be derived and comparisons made among abilities and skills required and levels needed. Graphs, bar charts, and distance measures can provide bases for comparison of the key differences between any two given jobs. A logical extension of this capability is the development of a metric for concisely portraying job difficulty so that new job data can be easily converted and compared using one or more quantitative indices.

An example of this approach would be an Intelligence Load Index (ILI), representing some combination of abilities selected for a given job and the scaled level of effort required. Several steps are required in developing such an index. Table 33 shows the results of adding, within each intelligence activity for each

Table 33

Numbers of Abilities Selected by Intelligence Activity and MOS

MOS	Intelligence Activity*: Abilities Selected								No. Abilities**
	P	S	C	M	A	I	P	D	
96B	8	1	2	2	5	4	3	3	11
96D	6	5	5	4	12	13	4	3	17
96H	10	10	18	0	0	0	1	4	31
96R	6	27	24	6	9	12	13	13	39
97B	5	1	5	2	6	7	3	2	13
97E	16	16	20	15	15	14	15	15	20
97G	19	21	21	21	21	20	20	20	21
Number Abilities***	22	35	39	24	29	27	26	24	

*P = PLANNING
S = SETTING-UP OR PREPARING
C = COLLECTING DATA
M = MANAGING OR CATALOGING DATA
A = ANALYZING OR EXPLOITING DATA
I = INTERPRETING DATA
P = PREPARING OUTPUTS
D = DISSEMINATING INFORMATION

**Total number of abilities (of 50) used by raters in each MOS

***Total number of abilities (of 50) used by raters for each intelligence activity

MOS, the number of abilities rated by SMEs (using an 80% rater agreement level as a cut-off criterion). The total number of abilities within an activity varies from 0 for 96H in MANAGING OR CATALOGING DATA to 27 for 96R in the SETTING-UP OR PREPARING activity. Table 34 shows the mean value within each activity for all the activities. A multiplicative combination of the cell entries in both tables gives an indication of the relative difficulty of performing a given activity within an MOS.

The results of this kind of computation are shown in Table 35. These numbers indicate that for PLANNING, the relative difficulty for 96B is 43.2, whereas for 97E it is 76.8. The difference in these figures may indicate that PLANNING is a more demanding task for the 97E. The highest entry in this table is 137.8, the SETTING-UP OR PREPARING activity performed by 96R. When a new IEW job is assessed using the MI JCAT system on skills and abilities, similar comparisons can be drawn to existing MOSs.

The index is simplistic and based on assumptions that combining certain judgements is logical and statistically acceptable. The index does not take into account the types of abilities embedded in each intelligence activity or the relative differences among the definitions of the intelligence activities that may have been assumed by the different MOS holders. These and other considerations would be necessary for the derivation of a final index. However, the search for an occupational difficulty index is an important component of the development of the overall crosswalk method for the comparison and assessment of new jobs in the IEW inventory.

Preliminary comparisons can be made at this point between the weighted ILI presented in this section and the index presented in the preceding section of this chapter. That earlier measure was based on the total number of uses of all abilities by all raters within an MOS for each intelligence activity. It did not take into account the estimated level of effort as does the weighted index presented in this section. Both indices provide ways of estimating differences in load from activity to activity.

To compare the results of these two ways of estimating load, the activity that each index identifies as the one placing the heaviest load on each MOS is listed in Table 36. As the table shows, for four of the MOSs, 96H 96R, 97B, and 97E, the two indices agree on which activity is the most demanding. For both 96H and 97E, the load associated with COLLECTING DATA was rated heaviest by both indices. For 96R, the agreement was on SETTING-UP OR PREPARING; for 97B, the choice was INTERPRETING DATA. For each of the other three MOSs, the activity ranked most demanding was a function of the measure used.

Table 34

Mean Level of Abilities by Intelligence Activity and MOS

MOS	Intelligence Activity*: Mean Level of Abilities							
	P	S	C	M	A	I	P	D
96B	5.4	5.0	5.7	5.2	5.7	5.5	4.8	5.5
96D	5.5	5.0	5.5	5.2	6.3	6.3	5.7	6.0
96H	4.4	4.4	5.1	-	-	-	3.0	4.0
96R	5.1	5.3	5.4	5.0	5.0	5.1	4.8	4.7
97B	4.8	5.0	4.9	5.2	5.1	5.1	5.3	5.2
97E	4.8	4.4	5.6	4.6	4.5	4.3	4.4	4.4
97G	5.1	4.9	5.5	5.1	5.6	5.5	5.1	4.7

*P = PLANNING
S = SETTING-UP OR PREPARING
C = COLLECTING DATA
M = MANAGING OR CATALOGING DATA
A = ANALYZING OR EXPLOITING
I = INTERPRETING DATA
P = PREPARING OUTPUTS
D = DISSEMINATING INFORMATION

Table 35

An Intelligence Load Index (ILI)

MOS	Intelligence Activity*: ILI								MEAN
	P	S	C	M	A	I	P	D	
96B	43.2	5.0	11.4	10.4	28.5	22.0	14.4	16.5	18.9
96D	33.0	25.0	30.3	20.8	75.6	81.9	22.8	18.0	38.4
96H	44.1	44.6	102.9	0	0	0	3.0	16.0	26.3
96R	30.6	137.8	129.6	30.0	45.0	61.2	62.4	61.1	69.7
97B	24.0	5.0	24.5	10.4	30.6	40.8	15.9	10.4	20.2
97E	76.8	70.4	112.0	69.0	67.5	60.2	66.0	66.0	73.5
97G	96.9	102.9	115.5	107.1	117.6	110.0	102.0	94.0	105.8
MEAN	49.8	55.8	75.2	35.4	52.1	53.7	40.9	40.3	

*P = PLANNING
S = SETTING-UP OR PREPARING
C = COLLECTING DATA
M = MANAGING OR CATALOGING DATA
A = ANALYZING OR EXPLOITING
I = INTERPRETING DATA
P = PREPARING OUTPUTS
D = DISSEMINATING INFORMATION

Table 36

Intelligence Production Activity with Heaviest Load as Estimated by Two Intelligence Load Indices

MOS	TOTAL ABILITY USES INDEX	WEIGHTED LEVEL OF EFFORT INDEX
96B	SETTING-UP	PLANNING
96D	ANALYZING	INTERPRETING
96H	COLLECTING	COLLECTING
96R	SETTING-UP	SETTING-UP
97B	INTERPRETING	INTERPRETING
97E	COLLECTING	COLLECTING
97G	SETTING-UP	ANALYZING

For 96B, the total uses index indicated that SETTING-UP OR PREPARING was the most demanding activity. According to that index, ANALYZING OR EXPLOITING DATA was second highest, and PLANNING was a close third. The second index, the weighted measure that takes level of effort into account and includes only the abilities selected by at least 80% of the raters for a given MOS, put PLANNING at the top for MOS 96B and put SETTING-UP OR PREPARING at the very bottom. That is, the activity that one index rates as having the heaviest load is rated by the other index as having the lightest load. In this case, a detailed look at the data reveals that only one ability, PROBLEM SENSITIVITY, was considered necessary for PLANNING by enough of the raters to meet the 80% criterion. The average of the raters' estimates of how much of the ability was needed was 5.0, so the weighted ILI for 96B for SETTING-UP OR PREPARING was 5.0. The raters picked many other abilities as needed for 96B SETTING-UP OR PREPARING, so the earlier load index based on total uses of abilities by all raters showed a high score. Raters simply did not agree on which abilities were needed. Neither index seems to reflect the raters' judgements or the demands of the job completely enough in this case.

The two indices produce different results for MOS 96D, also, but the lack of agreement is less notable. Two activities, ANALYZING OR EXPLOITING DATA and INTERPRETING DATA, held the first two places, but which was first and which was second depended on the index used. Thus, for 96D the indices present reasonably consistent results.

The third MOS on which the two indices disagree is 96G. SETTING-UP OR PREPARING is the activity judged to have the heaviest load by the total use index. That index rates the next most demanding activities, in decreasing order, as COLLECTING DATA, MANAGING OR CATALOGING DATA, and ANALYZING OR EXPLOITING DATA. ANALYZING OR EXPLOITING DATA, the activity ranked fourth by the first index, is rated first by the second index. SETTING-UP OR PREPARING, the activity judged to have the highest demand by the first index, is rated fifth heaviest by the second index. As in the case of 96B, the difference is great enough for 97G to indicate that additional analysis is needed.

The factors contributing to the differences need to be clarified, the causes and consequences of these differences weighed, and new indices developed or modifications made in existing indices and procedures established for their proper use. One factor that should not be forgotten is that the data being used represent the first collected with a new test instrument (Part C). As its use is refined, some of the differences due to

varying interpretations of the rating task may disappear. Such differences could account for the lack of agreement between the two load indices.

Analysis of Intelligence Production Activities

Planning. Table 37 shows the ability selections made for each of the seven MOSs for the PLANNING activity. (Here, as in the other discussions of the activities, the 80% rater agreement level is used as the criterion for inclusion in the table.) As the table shows, the pattern of ability selections varies from one MOS to another. No group of common abilities constitutes a core of abilities needed to perform this activity. Only one ability, ORAL EXPRESSION, appears in all seven MOSs, although a general emphasis on the communication abilities is evident. Five of the MOSs use all four communication abilities; MOS 96R uses only three and 97B only one.

Six of the MOSs (all but 96D) use some of the eight conceptual abilities in PLANNING; 97G uses seven of the eight. Six of the MOSs use some of the reasoning abilities; MOS 96R is the exception in this case. Two conceptual (MEMORIZATION and PROBLEM SENSITIVITY) and two reasoning (DEDUCTIVE REASONING and INFORMATION ORDERING) abilities are used by five of the seven MOSs, but which five depends on which ability. Abilities from only two other clusters, time-loaded and auditory abilities, appear in PLANNING profiles, and then only for two MOSs, 97E and 97G.

The number of abilities as well as the selection of abilities varies widely across the MOSs for PLANNING. MOS 97B uses the fewest abilities in PLANNING (5) and 97G uses the most (19). The greatest overlap in terms of needed abilities occurs between 97E and 97G; they share 15 abilities. The average number of abilities used across the seven MOSs in PLANNING is 10.

PLANNING is principally a mental, not a physical, activity. None of the visual abilities, none of the psychomotor skills, and none of the gross motor skills received enough support to meet the 80% criterion.

As might be expected, identifying a general profile for PLANNING is neither appropriate nor meaningful. Different MOSs have different PLANNING tasks and consequently need different abilities. For PLANNING to be meaningful in terms of ability demands, the focus should be kept at the MOS level or below.

Setting-Up or Preparing. Table 38 presents Part C data with SETTING-UP OR PREPARING as the focus. This activity shows even less consistency than PLANNING did from one MOS to another. No

Table 37

Ability Profiles for PLANNING

	ABILITY (No. and Name)	96B	96D	96H	96R	97B	97E	97G	
1	ORAL COMPREHENSION	5.9	5.4	5.1	4.8		6.1	5.3	
2	WRITTEN COMPREHENSION	6.4	5.8	4.9	5.6		5.9	5.7	
3	ORAL EXPRESSION	6.1	5.6	4.4	4.8	4.6	5.0	6.0	
4	WRITTEN EXPRESSION	5.3	5.8	4.3			5.0	5.9	
5	MEMORIZATION	4.4		4.9	5.4		6.0	5.3	
6	PROBLEM SENSITIVITY	5.0			4.9	4.9	4.8	5.3	
7	ORGINALITY						5.2	5.4	
8	FLUENCY OF IDEAS	4.8		3.7			5.0	5.1	
9	FLEXIBILITY OF CLOSURE							4.8	
10	SELECTIVE ATTENTION						4.3	5.1	
11	SPATIAL ORIENTATION					3.8		3.9	
12	VISUALIZATION				5.2				
13	INDUCTIVE REASONING						5.5	5.3	
14	CATEGORY FLEXIBILITY								
15	DEDUCTIVE REASONING	4.9		4.4		5.6	5.0	5.8	
16	INFORMATION ORDERING		5.1	4.9		5.5	4.4	4.8	
17	MATH REASONING			3.6				4.4	
18	NUMBER FACILITY		5.2	4.0					
19	TIME SHARING						4.6	5.4	
20	SPEED OF CLOSURE						4.8	4.9	
21	PERCEPTUAL SPD & ACCY							4.2	
22	REACTION TIME								
23	CHOICE REACTION TIME								
24	NEAR VISION								
25	FAR VISION								
26	NIGHT VISION								
27	VISUAL COLOR DISC								
28	PERIPHERAL VISION								
29	DEPTH PERCEPTION								
30	GLARE SENSITIVITY								
31	GENERAL HEARING						2.3	3.8	
32	AUDITORY ATTENTION						3.0		
33	SOUND LOCALIZATION								
34	CONTROL PRECISION								
35	RATE CONTROL								
36	WRIST-FINGER SPEED								
37	FINGER DEXTERITY								
38	MANUAL DEXTERITY								
39	ARM-HAND STEADINESS								
40	MULTI-LIMB COORDINATION								
41	EXTENT FLEXIBILITY								
42	DYNAMIC FLEXIBILITY								
43	SPD OF LIMB MOVEMENT								
44	GROSS BODY EQUILIBRIUM								
45	GROSS BODY COORDINATN								
46	STATIC STRENGTH								
47	EXPLOSIVE STRENGTH								
48	DYNAMIC STRENGTH								
49	TRUNK STRENGTH								
50	STAMINA								
	Number:	8	6	10	6	5	16	19	70/10.0
	Total Amount:	42.8	32.9	44.2	30.7	24.4	76.9	96.4	
	Mean Amount:	5.4	5.5	4.4	5.1	4.9	4.8	5.1	

Table 38

Ability Profiles for SETTING-UP OR PREPARING

	ABILITY (No. and Name)	96B	96D	96H	96R	97B	97E	97G	
1	ORAL COMPREHENSION		4.8	4.8	5.0		5.3	4.8	
2	WRITTEN COMPREHENSION			4.8	4.3		5.8	5.3	
3	ORAL EXPRESSION		5.4	5.0	4.7	5.0	4.7	6.0	
4	WRITTEN EXPRESSION		5.1		5.0		4.5	5.2	
5	MEMORIZATION			4.4	5.3		5.6	4.4	
6	PROBLEM SENSITIVITY	5.0		4.6	5.7		4.1	5.4	
7	ORGINALITY						4.9	5.4	
8	FLUENCY OF IDEAS						4.1	5.4	
9	FLEXIBILITY OF CLOSURE							4.6	
10	SELECTIVE ATTENTION						3.8	5.4	
11	SPATIAL ORIENTATION				5.7			4.9	
12	VISUALIZATION				5.8				
13	INDUCTIVE REASONING						4.6	5.0	
14	CATEGORY FLEXIBILITY								
15	DEDUCTIVE REASONING			4.1			4.4	5.3	
16	INFORMATION ORDERING		4.6	4.8			4.2	4.7	
17	MATH REASONING			3.4	5.1			4.3	
18	NUMBER FACILITY		5.0		4.7				
19	TIME SHARING			4.1			4.3	5.3	
20	SPEED OF CLOSURE				4.8		4.6	4.9	
21	PERCEPTUAL SPD & ACCY							4.4	
22	REACTION TIME								
23	CHOICE REACTION TIME							3.2	
24	NEAR VISION			4.3	4.6				
25	FAR VISION				5.1				
26	NIGHT VISION				5.9				
27	VISUAL COLOR DISC								
28	PERIPHERAL VISION				5.4				
29	DEPTH PERCEPTION				5.0				
30	GLARE SENSITIVITY								
31	GENERAL HEARING						2.3	3.9	
32	AUDITORY ATTENTION						3.0	4.4	
33	SOUND LOCALIZATION								
34	CONTROL PRECISION								
35	RATE CONTROL				5.4				
36	WRIST-FINGER SPEED				5.6				
37	FINGER DEXTERITY				5.4				
38	MANUAL DEXTERITY				5.6				
39	ARM-HAND STEADINESS				5.3				
40	MULTI-LIMB COORDINATION				5.9				
41	EXTENT FLEXIBILITY								
42	DYNAMIC FLEXIBILITY								
43	SPD OF LIMB MOVEMENT				5.2				
44	GROSS BODY EQUILIBRIUM				5.1				
45	GROSS BODY COORDINATN								
46	STATIC STRENGTH				5.7				
47	EXPLOSIVE STRENGTH				5.7				
48	DYNAMIC STRENGTH								
49	TRUNK STRENGTH								
50	STAMINA								
	Number:	1	5	10	26	1	16	21	80/11.4
	Total Amount:	5.0	24.9	44.3	137.0	5.0	70.4	102.2	
	Mean Amount:	5.0	5.0	4.4	5.3	5.0	4.4	4.9	

one ability is common to all seven MOSs. Two MOSs (96B and 97B) were judged to need only one ability each, whereas MOS 96R uses 26 abilities. The average number of abilities that an MOS uses in the SETTING-UP OR PREPARING activity is 11.4.

The concentration on the communication cluster of abilities is less marked for SETTING-UP OR PREPARING than it was for PLANNING. Abilities from each of the clusters appear in the lists of one or more of the MOSs. Abilities from some clusters appear in only one MOS; different selections of communication, conceptual, and reasoning abilities appear in five of the seven MOSs. The MOS needing 26 abilities (96R) draws them from seven different clusters. Obviously, SETTING-UP OR PREPARING means very different things to the different MOSs.

Collecting Data. Table 39 presents data from Part C with the COLLECTING DATA activity as the focus. As with the first two activities discussed, the MOSs differ greatly with respect to the number of abilities they need (from 2 to 24, with an average of 13.9) and which abilities they need. Four MOSs have 20 or more abilities in their profiles for COLLECTING DATA; the other three MOSs have 5 or fewer abilities.

No one ability appears in all seven MOSs. No one cluster is even represented in each MOS. Some parallels can be drawn between pairs of MOSs. For example, similarities exist between the abilities needed by 96D and 97B. Both need two communication abilities, ORAL COMPREHENSION and one other; both need the same conceptual ability, SELECTIVE ATTENTION, and the same reasoning ability, INFORMATION ORDERING. Finally, both need a time-loaded ability. Similarities also exist between 96H and 96R and between 97E and 97G. The remaining MOS, 96B, has only two abilities, ORAL and WRITTEN COMPREHENSION, in its profile. (Three other MOSs have the same two.)

Clearly, no one pattern of ability selections represents the COLLECTING DATA activity. No focus on one or another cluster of abilities emerges. Different MOSs do different things when they collect data, so differences in ability selections are to be expected.

Managing or Cataloging Data. Table 40 shows the C data for a fourth activity, MANAGING OR CATALOGING DATA. Again, no one ability appears among the abilities needed for this activity by each of the seven MOSs. The range in number of abilities needed varies from 0 (MOS 96H) to 21 (MOS 97G). The average number of abilities needed is 7.1, but that average means little. Two of the MOSs use a considerable number of abilities, while the other five use few or none. INFORMATION ORDERING is the most frequently used ability (by five of the MOSs), but the only

Table 39

Ability Profiles for COLLECTING DATA

	ABILITY (No. and Name)	96B	96D	96H	96R	97B	97E	97G
1	ORAL COMPREHENSION	5.4	4.5			6.2	7.0	5.8
2	WRITTEN COMPREHENSION	6.0	5.5		5.3		5.8	6.1
3	ORAL EXPRESSION				4.8	5.2	6.9	5.0
4	WRITTEN EXPRESSION						5.2	5.8
5	MEMORIZATION				5.3		6.0	4.3
6	PROBLEM SENSITIVITY						5.2	5.3
7	ORGINALITY						6.2	5.6
8	FLUENCY OF IDEAS						5.5	4.9
9	FLEXIBILITY OF CLOSURE			5.1	5.2			5.8
10	SELECTIVE ATTENTION		5.9	5.2	5.6	4.6	6.4	6.1
11	SPATIAL ORIENTATION			5.6	5.4		4.[illegible]	3.9
12	VISUALIZATION							
13	INDUCTIVE REASONING			3.7	5.3		5.8	6.5
14	CATEGORY FLEXIBILITY							
15	DEDUCTIVE REASONING				5.0		5.6	5.6
16	INFORMATION ORDERING		5.6			4.1	4.8	5.1
17	MATH REASONING				4.8			5.1
18	NUMBER FACILITY						4.8	
19	TIME SHARING		5.9	4.8	5.4		5.0	6.0
20	SPEED OF CLOSURE			4.7		4.5	6.1	6.3
21	PERCEPTUAL SPD & ACCY			5.4	5.4		5.6	5.1
22	REACTION TIME				5.5			
23	CHOICE REACTION TIME			5.1	6.1			4.4
24	NEAR VISION			5.5	4.9		5.0	
25	FAR VISION			6.4				
26	NIGHT VISION			6.1	5.6			
27	VISUAL COLOR DISC			5.5				
28	PERIPHERAL VISION			5.9				
29	DEPTH PERCEPTION			5.4	5.3			
30	GLARE SENSITIVITY			5.1	4.8			
31	GENERAL HEARING			5.3	5.9		5.4	5.9
32	AUDITORY ATTENTION				5.7		5.7	6.1
33	SOUND LOCALIZATION				5.6			
34	CONTROL PRECISION			4.1	5.6			
35	RATE CONTROL			4.7				
36	WRIST-FINGER SPEED				5.8			
37	FINGER DEXTERITY			4.7	5.8			
38	MANUAL DEXTERITY							
39	ARM-HAND STEADINESS							
40	MULTI-LIMB COORDINATION							
41	EXTENT FLEXIBILITY			4.6				
42	DYNAMIC FLEXIBILITY							
43	SPD OF LIMB MOVEMENT				5.8			
44	GROSS BODY EQUILIBRIUM							
45	GROSS BODY COORDINATN							
46	STATIC STRENGTH							
47	EXPLOSIVE STRENGTH							
48	DYNAMIC STRENGTH							
49	TRUNK STRENGTH							
50	STAMINA							
	Number:	2	5	20	24	5	20	21
	Total Amount:	11.4	27.4	102.9	129.9	24.6	112.9	114.9
	Mean Amount:	5.7	5.5	5.1	5.4	4.9	5.6	5.5

Table 40

Ability Profiles for MANAGING OR CATALOGING DATA

	ABILITY (No. and Name)	96B	96D	96H	96R	97B	97E	97Q	
1	ORAL COMPREHENSION						5.1	5.3	
2	WRITTEN COMPREHENSION	5.4			5.1		4.8	6.1	
3	ORAL EXPRESSION				5.1		4.6	5.3	
4	WRITTEN EXPRESSION		5.2			5.2	6.0	5.4	
5	MEMORIZATION						5.2	5.2	
6	PROBLEM SENSITIVITY		4.3				4.5	5.4	
7	ORGINALITY						4.0	4.9	
8	FLUENCY OF IDEAS						3.8	4.4	
9	FLEXIBILITY OF CLOSURE							5.1	
10	SELECTIVE ATTENTION		5.8				4.7	5.4	
11	SPATIAL ORIENTATION							3.6	
12	VISUALIZATION								
13	INDUCTIVE REASONING						5.2	6.1	
14	CATEGORY FLEXIBILITY								
15	DEDUCTIVE REASONING						4.7	5.4	
16	INFORMATION ORDERING	4.9	5.6			5.2	4.8	5.2	
17	MATH REASONING				4.8			4.4	
18	NUMBER FACILITY				4.8				
19	TIME SHARING				4.9			5.3	
20	SPEED OF CLOSURE						5.0	6.0	
21	PERCEPTUAL SPD & ACCY							4.5	
22	REACTION TIME				5.3				
23	CHOICE REACTION TIME							4.4	
24	NEAR VISION								
25	FAR VISION								
26	NIGHT VISION								
27	VISUAL COLOR DISC								
28	PERIPHERAL VISION								
29	DEPTH PERCEPTION								
30	GLARE SENSITIVITY								
31	GENERAL HEARING						2.4	4.7	
32	AUDITORY ATTENTION						3.8	5.7	
33	SOUND LOCALIZATION								
34	CONTROL PRECISION								
35	RATE CONTROL								
36	WRIST-FINGER SPEED								
37	FINGER DEXTERITY								
38	MANUAL DEXTERITY								
39	ARM-HAND STEADINESS								
40	MULTI-LIMB COORDINATION								
41	EXTENT FLEXIBILITY								
42	DYNAMIC FLEXIBILITY								
43	SPD OF LIMB MOVEMENT								
44	GROSS BODY EQUILIBRIUM								
45	GROSS BODY COORDINATN								
46	STATIC STRENGTH								
47	EXPLOSIVE STRENGTH								
48	DYNAMIC STRENGTH								
49	TRUNK STRENGTH								
50	STAMINA								
	Number:	2	4	0	6	2	15	21	50/7.1
	Total Amount:	10.3	20.9	0	30.0	10.4	68.6	107.8	
	Mean Amount:	5.2	5.2	0	5.0	5.2	4.6	5.1	

notable similarity in selection of abilities is that between MOS 97E and MOS 97G. All 15 of the abilities needed by 97E are also included among the 21 abilities needed by 97G. The same five clusters are represented, but 97G needs a richer selection within these clusters.

In terms of abilities needed, no generic group of abilities seems to be needed for MANAGING OR CATALOGING DATA. These data indicate that what one MOS needs to manage data is different than what another needs, and that 96H does not perform this activity.

Analyzing or Exploiting Data. Table 41 shows Part C data for the ANALYZING OR EXPLOITING DATA activity. Once again, no ability selections appear for MOS 96H. The number of abilities needed by the other six MOSs ranges from 5 (96B) to 21 (97G), with an average of 9.3 based on seven MOSs (or 10.8 based on six).

The six MOSs that have abilities listed for the ANALYZING OR EXPLOITING DATA activity share two abilities, WRITTEN COMPREHENSION and PROBLEM SENSITIVITY. Five of the six share a third ability, DEDUCTIVE REASONING. These three abilities seem so reasonably related to ANALYZING OR EXPLOITING DATA that it is surprising the sixth MOS (96R) does not have a need for DEDUCTIVE REASONING or any other reasoning ability. A recheck of the data shows that seven of the nine 96R raters did select this ability (and rated it 4.9 on the 7-point scale). However, that represents only 78% of the raters, not the 80% needed, so the ability was not included in the 96R profile for ANALYZING OR EXPLOITING DATA.

The three abilities discussed above may constitute a core set of abilities needed for the ANALYZING OR EXPLOITING DATA activity. Additional ability needs associated with each specific MOS may be a function of how analysis is carried out by that MOS. (For example, visual abilities are a special need for 96D and psychomotor skills for 96R.) Those special needs may dictate that the focus must remain at the MOS level and that there is no generic profile for the ANALYZING OR EXPLOITING DATA activity.

Interpreting Data. Table 42 presents Part C data for the INTERPRETING DATA activity. The number of abilities needed by an MOS for INTERPRETING DATA ranges from 0 to 20; the mean is 10.1 abilities per MOS (or 11.8 if only the six non-zero MOSs are averaged). The six MOSs involved in INTERPRETING DATA, according to these results, need abilities from at least three clusters. The emphasis across the MOSs is on the communication cluster, with the conceptual and reasoning clusters also represented by at least one ability each. In two cases, 97E and 97G, half or more of the specific abilities in the latter two clusters are included

Table 41

Ability Profiles for ANALYZING OR EXPLOITING DATA

	ABILITY (No. and Name)	96B	96D	96H	96R	97B	97E	97G
1	ORAL COMPREHENSION						4.4	5.9
2	WRITTEN COMPREHENSION	5.4	6.2		5.3	5.5	4.9	5.9
3	ORAL EXPRESSION				5.4		4.5	5.7
4	WRITTEN EXPRESSION	5.8				4.6	5.2	6.1
5	MEMORIZATION		6.4				5.2	4.0
6	PROBLEM SENSITIVITY	5.6	5.4		5.0	4.8	4.5	6.0
7	ORGINALITY						4.3	5.5
8	FLUENCY OF IDEAS						3.7	5.5
9	FLEXIBILITY OF CLOSURE				4.6	5.3		6.5
10	SELECTIVE ATTENTION		6.1			4.6	4.3	6.3
11	SPATIAL ORIENTATION		5.5					4.9
12	VISUALIZATION				5.3			
13	INDUCTIVE REASONING	5.8					5.6	6.4
14	CATEGORY FLEXIBILITY							
15	DEDUCTIVE REASONING	6.0	6.4			5.8	4.9	5.8
16	INFORMATION ORDERING						4.0	5.0
17	MATH REASONING		6.7					4.9
18	NUMBER FACILITY		6.4					
19	TIME SHARING							5.9
20	SPEED OF CLOSURE				4.7		4.6	6.5
21	PERCEPTUAL SPD & ACCY		6.1					5.6
22	REACTION TIME				5.0			
23	CHOICE REACTION TIME							3.8
24	NEAR VISION		6.8					
25	FAR VISION		6.4					
26	NIGHT VISION							
27	VISUAL COLOR DISC							
28	PERIPHERAL VISION							
29	DEPTH PERCEPTION		6.8					
30	GLARE SENSITIVITY							
31	GENERAL HEARING						2.5	5.9
32	AUDITORY ATTENTION						4.2	6.1
33	SOUND LOCALIZATION							
34	CONTROL PRECISION							
35	RATE CONTROL				5.0			
36	WRIST-FINGER SPEED							
37	FINGER DEXTERITY				4.8			
38	MANUAL DEXTERITY							
39	ARM-HAND STEADINESS							
40	MULTI-LIMB COORDINATION							
41	EXTENT FLEXIBILITY							
42	DYNAMIC FLEXIBILITY							
43	SPD OF LIMB MOVEMENT							
44	GROSS BODY EQUILIBRIUM							
45	GROSS BODY COORDINATN							
46	STATIC STRENGTH							
47	EXPLOSIVE STRENGTH							
48	DYNAMIC STRENGTH							
49	TRUNK STRENGTH							
50	STAMINA							
	Number:	5	12	0	9	6	15	21
	Total Amount:	28.6	75.2	0	45.1	30.6	66.8	118.2
	Mean Amount:	5.7	6.3	0	5.0	5.1	4.5	5.6

Table 42

Ability Profiles for INTERPRETING DATA

	ABILITY (No. and Name)	96B	96D	96H	96R	97B	97E	97G
1	ORAL COMPREHENSION	4.6	4.9			5.6	4.6	5.9
2	WRITTEN COMPREHENSION	5.7	6.2		5.6	5.9	4.8	6.0
3	ORAL EXPRESSION				5.5		4.3	4.5
4	WRITTEN EXPRESSION		6.1			5.3	4.1	5.7
5	MEMORIZATION		6.3				4.3	4.7
6	PROBLEM SENSITIVITY				4.9	5.1	4.7	5.5
7	ORGINALITY						4.3	5.1
8	FLUENCY OF IDEAS						5.0	5.5
9	FLEXIBILITY OF CLOSURE				5.3	4.6		6.6
10	SELECTIVE ATTENTION		5.9		5.9		3.8	6.2
11	SPATIAL ORIENTATION							4.7
12	VISUALIZATION	5.6						
13	INDUCTIVE REASONING						5.6	6.2
14	CATEGORY FLEXIBILITY							
15	DEDUCTIVE REASONING	6.1	6.8			5.7	5.0	5.5
16	INFORMATION ORDERING		6.2				3.6	4.9
17	MATH REASONING		6.8		4.4			4.6
18	NUMBER FACILITY		6.2		4.7			
19	TIME SHARING				4.9			6.0
20	SPEED OF CLOSURE					4.5		6.1
21	PERCEPTUAL SPD & ACCY		6.3		4.9			5.4
22	REACTION TIME				4.9			
23	CHOICE REACTION TIME							
24	NEAR VISION		6.8					
25	FAR VISION		6.4					
26	NIGHT VISION							
27	VISUAL COLOR DISC							
28	PERIPHERAL VISION							
29	DEPTH PERCEPTION		6.9					
30	GLARE SENSITIVITY							
31	GENERAL HEARING				5.4		3.1	5.5
32	AUDITORY ATTENTION					4.0	3.2	6.1
33	SOUND LOCALIZATION							
34	CONTROL PRECISION				5.1			
35	RATE CONTROL							
36	WRIST-FINGER SPEED							
37	FINGER DEXTERITY							
38	MANUAL DEXTERITY							
39	ARM-HAND STEADINESS							
40	MULTI-LIMB COORDINATION							
41	EXTENT FLEXIBILITY							
42	DYNAMIC FLEXIBILITY							
43	SPD OF LIMB MOVEMENT							
44	GROSS BODY EQUILIBRIUM							
45	GROSS BODY COORDINATN							
46	STATIC STRENGTH							
47	EXPLOSIVE STRENGTH							
48	DYNAMIC STRENGTH							
49	TRUNK STRENGTH							
50	STAMINA							
	Number:	4	13	0	12	8	14	20
	Total Amount:	22.0	81.8	0	61.5	40.7	60.3	110.7
	Mean Amount:	5.5	6.3	0	5.1	5.1	4.3	5.5

in their profiles, but using so many of the abilities in these clusters is not typical of the other MOSs. Abilities from four other clusters (all but gross motor skills) are represented in one or four of the MOSs, which ones depending on the MOS.

No one ability is needed by all seven MOSs for this activity, but, since MOS 96H has no abilities listed, an ability needed by all of the remaining six MOSs could be considered a core ability. One ability, WRITTEN COMPREHENSION, does appear in all six profiles. In addition, if the criterion used for inclusion in the 96R profile had been 78% instead of 80%, two more abilities, ORAL COMPREHENSION and DEDUCTIVE REASONING, would have appeared in the profiles of all six MOSs. If a core of abilities for the INTERPRETING activity is a meaningful concept, that one reasoning ability and the two communication abilities seem appropriate candidates.

Preparing Outputs. Table 43 presents Part C data for the PREPARING OUTPUTS activity. The number of abilities needed by an MOS for this activity ranges from 1 to 20, with a mean of 8.4. The number of clusters represented within the profiles of the various MOSs ranges from one to six, with 96H at the low end and 96R at the high. For this activity, the MOSs apparently differ widely in terms of how many abilities they need, how many different kinds of abilities they need (represented by different clusters), and how many of the abilities within a cluster they need.

The one common factor for this activity is that all seven MOSs need WRITTEN EXPRESSION. In terms of other abilities needed and clusters used, MOSs 97E and 97G have fairly similar patterns. Otherwise, the profiles of the various MOSs for PREPARING OUTPUTS are quite dissimilar. Differences are so numerous that no analysis of the varying impact of different rater agreement criterion was attempted.

Disseminating Information. Table 44 assembles the Part C data for the DISSEMINATING INFORMATION activity. The number of abilities needed by an MOS varies from 2 (97B) to 20 (97G), with a mean of 8.6. The emphasis for this activity is on the communication abilities, with each MOS needing at least two and three MOSs needing all four. ORAL EXPRESSION appears in all seven profiles and WRITTEN EXPRESSION is needed by six of the seven MOSs. (WRITTEN EXPRESSION was considered necessary at the 6.0 level by 78% of the 96R raters, just missing the 80% inclusion criterion.)

Two of the MOSs were judged to need nothing but communication skills for DISSEMINATING INFORMATION. Two other MOSs have one need in other clusters, which one a function of the MOS. The

Table 43

Ability Profiles for PREPARING OUTPUTS

	ABILITY (No. and Name)	96B	96D	96H	96R	97B	97E	97Q
1	ORAL COMPREHENSION				4.3		4.2	6.1
2	WRITTEN COMPREHENSION				4.3		5.2	6.6
3	ORAL EXPRESSION				5.2		4.4	5.5
4	WRITTEN EXPRESSION	5.7	6.9	3.0	5.7	6.3	5.9	6.4
5	MEMORIZATION	4.6					4.0	4.1
6	PROBLEM SENSITIVITY				4.8		4.3	5.1
7	ORGINALITY						4.5	5.1
8	FLUENCY OF IDEAS	4.0					4.7	4.5
9	FLEXIBILITY OF CLOSURE							5.2
10	SELECTIVE ATTENTION		5.6		5.4		4.5	5.0
11	SPATIAL ORIENTATION							3.2
12	VISUALIZATION							
13	INDUCTIVE REASONING						5.3	5.7
14	CATEGORY FLEXIBILITY							
15	DEDUCTIVE REASONING						4.4	5.5
16	INFORMATION ORDERING		5.4			5.6	4.7	5.1
17	MATH REASONING				4.8			4.2
18	NUMBER FACILITY				4.7			
19	TIME SHARING							5.4
20	SPEED OF CLOSURE						4.0	5.3
21	PERCEPTUAL SPD & ACCY		5.0		4.4			4.9
22	REACTION TIME				4.6			
23	CHOICE REACTION TIME							
24	NEAR VISION				4.5			
25	FAR VISION							
26	NIGHT VISION				5.6			
27	VISUAL COLOR DISC							
28	PERIPHERAL VISION							
29	DEPTH PERCEPTION							
30	GLARE SENSITIVITY							
31	GENERAL HEARING						2.3	4.2
32	AUDITORY ATTENTION						3.0	4.8
33	SOUND LOCALIZATION							
34	CONTROL PRECISION				4.3			
35	RATE CONTROL							
36	WRIST-FINGER SPEED							
37	FINGER DEXTERITY					4.1		
38	MANUAL DEXTERITY							
39	ARM-HAND STEADINESS							
40	MULTI-LIMB COORDINATION							
41	EXTENT FLEXIBILITY							
42	DYNAMIC FLEXIBILITY							
43	SPD OF LIMB MOVEMENT							
44	GROSS BODY EQUILIBRIUM							
45	GROSS BODY COORDINATN							
4	STATIC STRENGTH							
47	EXPLOSIVE STRENGTH							
48	DYNAMIC STRENGTH							
49	TRUNK STRENGTH							
50	STAMINA							
	Number:	3	4	1	13	3	15	20
	Total Amount:	14.3	22.9	3.0	62.6	16.0	65.4	101.9
	Mean Amount:	4.8	5.7	3.0	4.8	5.3	4.4	5.1

Table 44

Ability Profiles for DISSEMINATING INFORMATION

	ABILITY (No. and Name)	96B	96D	96H	96R	97B	97E	97G
1	ORAL COMPREHENSION			4.3	4.6		5.0	5.4
2	WRITTEN COMPREHENSION			3.6	4.6		5.7	5.7
3	ORAL EXPRESSION	6.2	6.6	4.4	5.3	5.3	5.5	6.7
4	WRITTEN EXPRESSION	6.7	6.8	3.6		5.2	6.0	5.2
5	MEMORIZATION						4.0	4.0
6	PROBLEM SENSITIVITY				4.8		4.1	4.7
7	ORGINALITY						4.5	4.8
8	FLUENCY OF IDEAS	3.5					4.8	4.0
9	FLEXIBILITY OF CLOSURE							5.0
10	SELECTIVE ATTENTION				5.4		4.1	4.3
11	SPATIAL ORIENTATION							3.2
12	VISUALIZATION							
13	INDUCTIVE REASONING						4.0	4.9
14	CATEGORY FLEXIBILITY							
15	DEDUCTIVE REASONING				4.6		4.5	4.8
16	INFORMATION ORDERING						4.0	4.8
17	MATH REASONING				4.2			3.8
18	NUMBER FACILITY				4.5			
19	TIME SHARING				4.9			4.9
20	SPEED OF CLOSURE						3.5	4.8
21	PERCEPTUAL SPD & ACCY		4.7		4.4			4.3
22	REACTION TIME				5.3			
23	CHOICE REACTION TIME							
24	NEAR VISION				4.4			
25	FAR VISION							
26	NIGHT VISION							
27	VISUAL COLOR DISC							
28	PERIPHERAL VISION							
29	DEPTH PERCEPTION							
30	GLARE SENSITIVITY							
31	GENERAL HEARING						2.7	4.0
32	AUDITORY ATTENTION						3.1	4.3
33	SOUND LOCALIZATION							
34	CONTROL PRECISION				4.4			
35	RATE CONTROL							
36	WRIST-FINGER SPEED							
37	FINGER DEXTERITY							
38	MANUAL DEXTERITY							
39	ARM-HAND STEADINESS							
40	MULTI-LIMB COORDINATION							
41	EXTENT FLEXIBILITY							
42	DYNAMIC FLEXIBILITY							
43	SPD OF LIMB MOVEMENT							
44	GROSS BODY EQUILIBRIUM							
45	GROSS BODY COORDINATN							
46	STATIC STRENGTH							
47	EXPLOSIVE STRENGTH							
48	DYNAMIC STRENGTH							
49	TRUNK STRENGTH							
50	STAMINA							
	Number:	3	3	4	13	2	15	20
	Total Amount:	16.4	18.1	15.9	61.4	10.5	65.5	93.6
	Mean Amount:	5.5	6.0	4.0	4.7	5.3	4.4	4.7

other three MOSs use a wide range of abilities from many different clusters. Only gross motor skills fail to be represented at all in the DISSEMINATING INFORMATION profiles.

The key to DISSEMINATING INFORMATION lies in the communication abilities; these data document that obvious fact and illustrate it across the MOSs. What additional supporting abilities are needed depends on the MOS. As the table shows, for at least three of the MOSs those additional needs are fairly extensive. The differences between the profiles of the various MOSs for the DISSEMINATING INFORMATION activity are more notable than their similarities.

Across the Activities. The overall conclusion is the same regardless of the activity at issue. No core group of abilities can be associated with any of the eight intelligence production activities on the basis of the Part C data presented here and with a strict 80% rater agreement criterion. At most, the 96 CMF MOSs shared a need for one ability for certain activities. For both PLANNING and DISSEMINATING INFORMATION, all seven MOSs need ORAL EXPRESSION. For PREPARING OUTPUTS, all need WRITTEN EXPRESSION. None of the other five activities had even one ability common to all seven MOSs.

The ability profile for an activity varies from MOS to MOS. The ability profile for an MOS varies from activity to activity. Some MOSs use an ability in very few activities; other MOSs use the abilities in most of their activities. Table 45 summarizes these differences. As the table shows, the range goes from 1.5 activities per ability for MOS 96H, a very diffuse use of abilities, to 7.8 activities per ability for MOS 97G, a very dense use of abilities. As the table shows, MOS 97G not only uses the abilities it needs in almost every activity, it also has the highest mean number of abilities needed per activity (20.4). MOS 96B uses the fewest mean number of abilities (3.5 per activity) and also uses each ability in a low mean number of activities (2.5 per ability).

In a number of cases, similarity of ability profiles is greater within an MOS from one activity to another than it is for the same activity from one MOS to another. For both 97E and 97G, the ability profile looks much the same regardless of the activity. Other instances are less definitive. For example, the profiles for the ANALYZING OR EXPLOITING DATA and INTERPRETING DATA activities for MOS 96D appear more similar to one another than they do to profiles for these same activities for other MOSs. However, until a satisfactory measure of similarity is developed for these profiles, no quantitative comparisons can be made.

Table 45

Summary of Density of Ability Usage

MOS	MEAN NO. ACTIVITIES/ABILITY	MEAN NO. ABILITIES/ACTIVITY
96B	2.5	3.5
96D	3.1	6.5
96H	1.5	5.6
96R	2.8	13.6
97B	2.5	4.0
97E	6.3	15.8
97G	7.8	20.4

Table 46 permits an easy comparison of the number of abilities various MOS need depending on the activity being performed. According to the Part C data, MOS 96B usually needs only a few abilities, whereas MOSs 97E and 97G consistently need many abilities. The greatest variability across activities is encountered by MOS 96H (from 0 to 20 abilities) and by 96R (from 6 to 26 abilities). COLLECTING DATA has the highest mean number of abilities needed across the MOSs, although for four MOSs one or more other activities need more abilities. The number of abilities needed is only one indication of the difficulty of a job associated with an MOS and an activity.

In another type of summary, Table 47 shows how many different clusters of abilities are called into play in performing an activity. This table shows the number of ability clusters represented in the profiles of the various MOSs for each of the eight activities. The maximum number that can appear in a cell is eight, since there are eight clusters if the auditory and visual abilities are considered separate clusters.

Only one MOS and one activity use abilities from all eight clusters (96R in the COLLECTING DATA activity). That same MOS has the highest mean number of clusters involved across eight activities (5.3). Two other MOSs, 97E and 97G, have means almost as large (5.0 in both cases); these two MOSs have the most consistent pattern of use across the activities. MOS 97G does not vary at all, using the same five clusters whatever the activity. MOS 96H has the lowest mean of clusters used (2.1), primarily because no need for any abilities is shown for three of the eight activities. However, 96H uses seven clusters for COLLECTING DATA, so the range is greatest for this MOS. In terms of clusters used, COLLECTING DATA is most demanding for three of the MOSs (96H, 96R, and 97E) and least demanding for one (96B).

What does variability in terms of numbers of abilities or numbers of clusters of abilities used in performing an activity, or differences for an MOS from one activity to another, mean with respect to the difficulty of an MOS, the effectiveness of an MOS, or the training needed for an MOS? Some of these questions will be answered in the next report in this series.

Table 46

Number of Abilities Needed as a Function of Activity

	MOS							
INTELLIGENCE PRODUCTION ACTIVITY	96B	96D	96H	96R	97B	97E	97G	MEAN/ ACTIVITY
PLANNING	8	6	10	6	5	16	19	10.0
SETTING-UP OR PREPARING	1	5	10	26	1	16	21	11.4
COLLECTING DATA	2	5	20	24	5	20	21	13.9
MANAGING OR CATALOGING DATA	2	4	0	6	2	15	21	7.1
ANALYZING OR EXPLOITING DATA	5	12	0	9	6	15	21	9.3
INTERPRETING DATA	4	13	0	12	8	14	20	10.1
PREPARING OUTPUTS	3	4	1	13	3	15	20	8.4
DISSEMINATING INFORMATION	3	3	4	13	2	15	20	8.6
Mean MOS	3.5	6.5	5.6	13.6	4.0	15.8	20.4	9.9

Table 47

Number of Clusters Involved in Activities

	MOS						
INTELLIGENCE PRODUCTION ACTIVITY	96B	96D	96H	96R	97B	97E	97G
PLANNING	3	2	3	2	3	5	5
SETTING-UP OR PREPARING	1	2	5	7	1	5	5
COLLECTING DATA	1	4	7	8	4	6	5
MANAGING OR CATALOGING DATA	2	3	0	3	2	5	5
ANALYZING OR EXPLOITING DATA	3	5	0	4	3	5	5
INTERPRETING DATA	3	5	0	6	5	4	5
PREPARING OUTPUTS	2	4	1	6	3	5	5
DISSEMINATING INFORMATION	2	2	1	6	1	5	5
Mean	2.3	3.4	2.1	5.3	2.8	5.0	5.0

Using JCAT Data

The goal of collecting MOS abilities and skills data is not simply to analyze those abilities and skills, but to provide information about jobs and tasks to solve some general human resources problems. As an indication of these problems, and their solutions, consider the following areas:

New System Design. An example of the use of these data for new systems has just been given in the preceding section. Tentative system designs are proposed, and designs have to be evaluated. One dimension is in terms of workload demands; the UAV profile was an estimate of workload demands. The profile is also diagnostic in that it gives suggestions as to where to look in the system design for the tasks creating the demands.

Another use of these data is to compare alternative new designs or as a tool in so-called "comparability analysis" required in the HARDMAN and MANPRINT methodologies evaluating a new design against a predecessor (Booher & Hewitt, 1990, p. 356). The method here is to assess differentially the abilities and skills needed to perform tasks in the old and new systems or the alternative new systems.

Training Requirements. Mention has already been made of the use of JCAT data in establishing new training requirements. Also possible is a kind of "training comparability analysis" evaluating established training against new training requirements. The general question concerns the degree to which training must be changed as jobs change; as previously described, there has been some work done on predicting the impact of the new training requirement from its similarity to the old (Sparrow, 1989).

One particular issue of some importance is identifying general abilities and skills requirements and then training for these general skills prior to specific system training. Exactly how effective this might be remains an empirical question (Fleishman & Mumford, 1989).

Finally, many of the new MANPRINT methods require extensive quantitative tradeoff studies between training variables and other manpower and personnel dimensions. One may, for example, ask questions about the optimal balance of selection and training variables in achieving high levels of skill performance. JCAT abilities and skills data are ideal for this type of tradeoff.

Manpower and Personnel Actions. Every day in organizations decisions must be made about critical manpower and personnel actions. As one example, the anticipated introduction of a new system or set of jobs may require manpower not available in a

fixed-level force. Actions have to be taken on such questions as "Which members of the existing force are most applicable to the new system and what will be the human resources consequences of their transfer?" Another example is the requirement to decrease the quantity of the force, and questions arise such as "What will be the impact on the abilities and skills of the manpower pool with anticipated reductions?"

Beyond quantity will be questions of quality, "How adequate are present personnel to perform new jobs and what additional training, if any, will have to be provided?" JCAT data are particularly important to the question of personnel quality demands. Abilities and skills are identified, and the level of demand is both a qualitative and quantitative indication of personnel quality requirements. Conversely, the aptitude levels of the soldiers available will affect performance (Lowry & Seaver, 1988, pp. 28-30), and these data can be used to predict anticipated aptitude level requirements.

Selection Criteria. It is a well established truism that the closer selection parameters are to job dimensions the better the selection of personnel will be (many other things being equal). One problem in developing selection criteria is to have sufficient detailed information about the tasks, jobs, and job families and for that information to be in a form to be used in developing and using selection tools. JCAT data in abilities and skills are particularly appropriate for selection development.

Selection for the armed forces is a massive undertaking both conceptually and operationally. Since World War I, the United States has done a remarkable job in creating and sustaining an outstanding selection system. Constant efforts are made to improve the system such as the current Project "A" which, in part, is increasing the validity of selection tests and composites (Haas & Laine, 1990, pp. 512-513). But a major and ever-continuing need will always be to generate detailed job and task data, such as anticipated abilities and skills sets, to which selection criteria can be matched.

MOS and CMF Analysis. A very complex structure has been provided for Army personnel with respect to jobs and job families in the MOS and CMF system (Department of the Army, 1989). But the requirements for MOSs and CMFs are under constant change, and methods are needed for rational and effective transitions that will maximize effective personnel classification and utilization and minimize personnel hardships.

JCAT abilities and skills data provide a psychological basis for understanding MOSs and CMFs. The data can be used as one basis for evaluating the validity of MOSs and CMFs. The data can assist in changing MOSs and transitions among MOSs. As shown in the previous chapter, the data can serve to evaluate the fit

between existing MOSs and future system requirements. While not sufficient alone for MOS and CMF analysis, abilities and skills data can play a very effective role in MOS and CMF analysis and the subsequent actions taken to improve career management.

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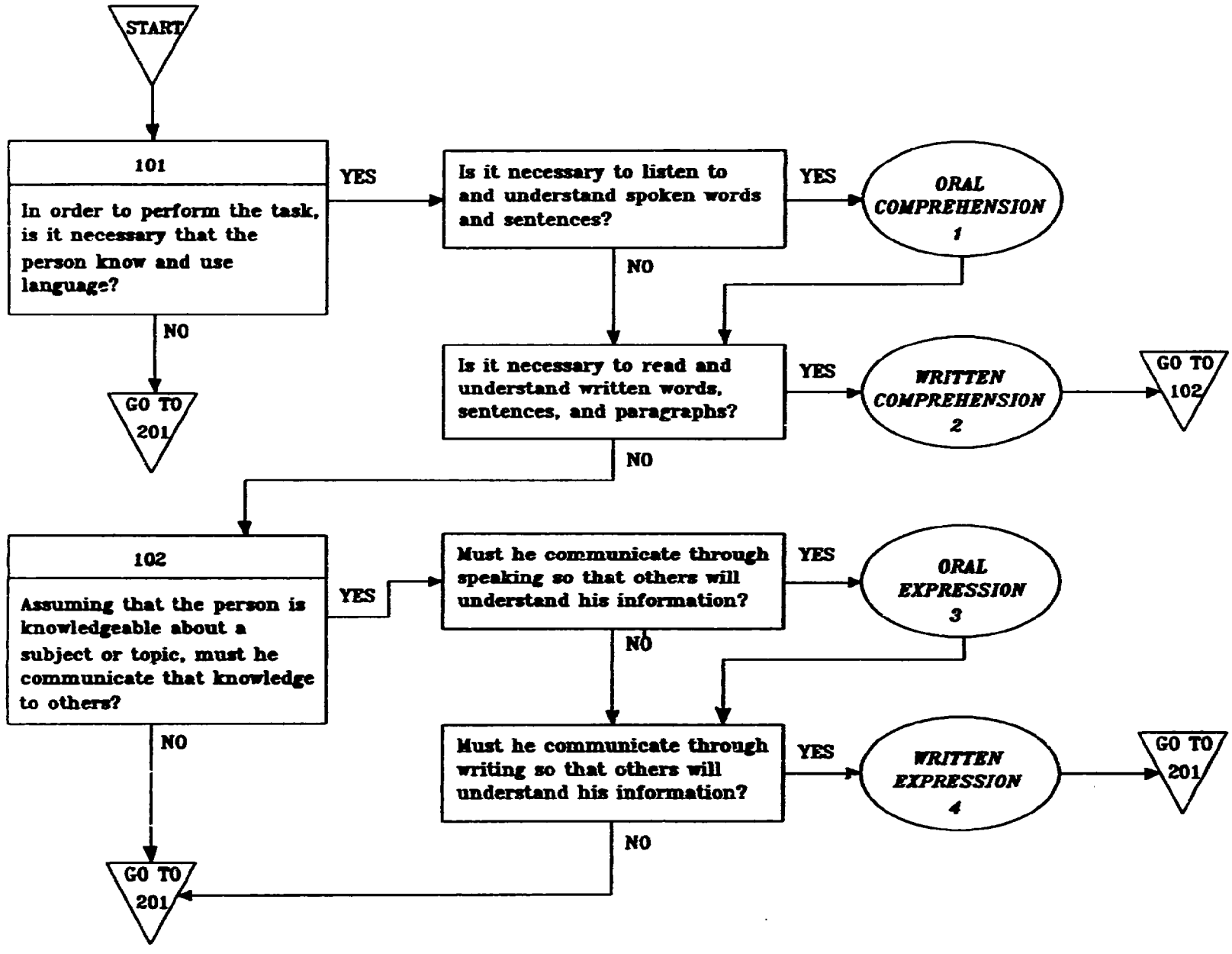
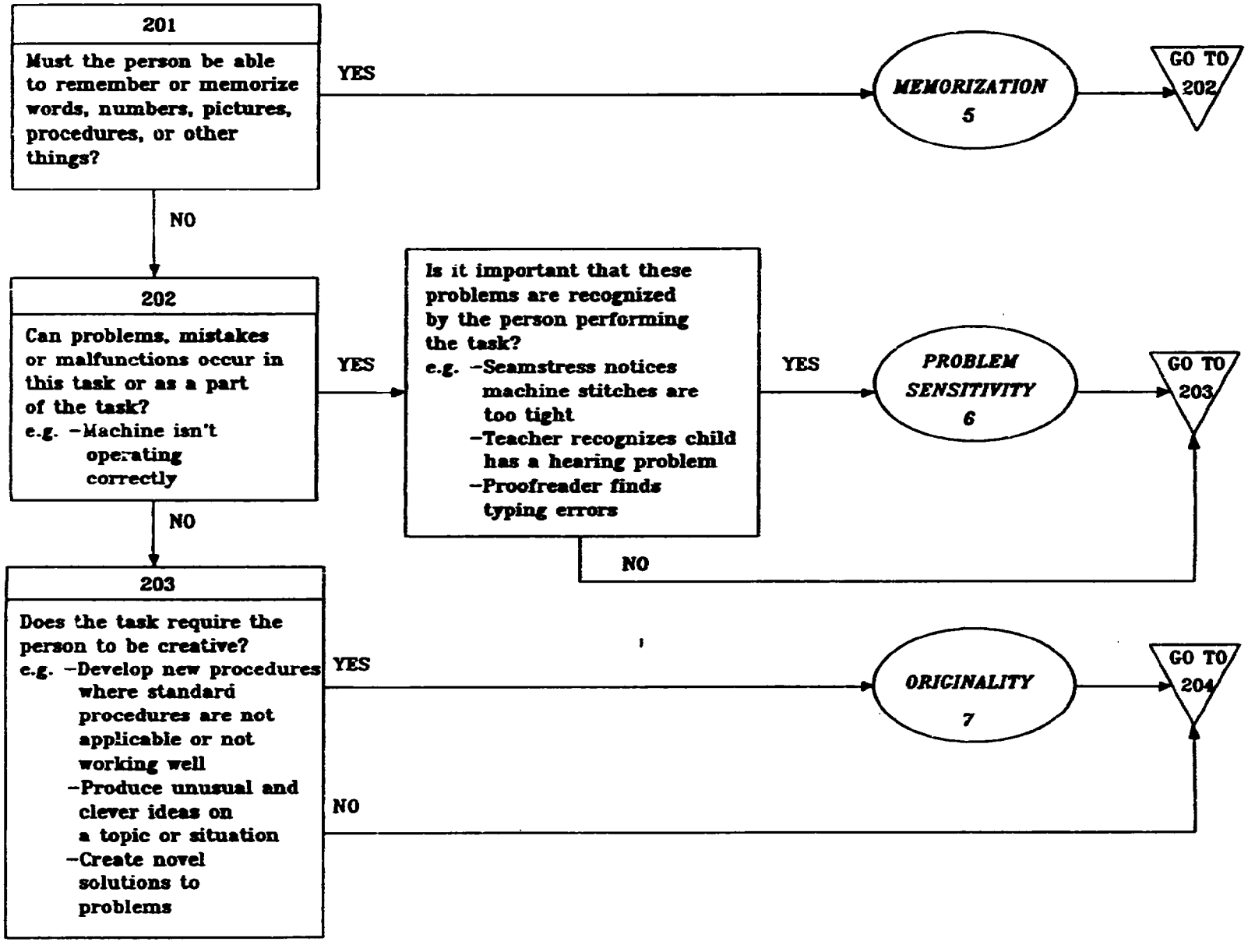
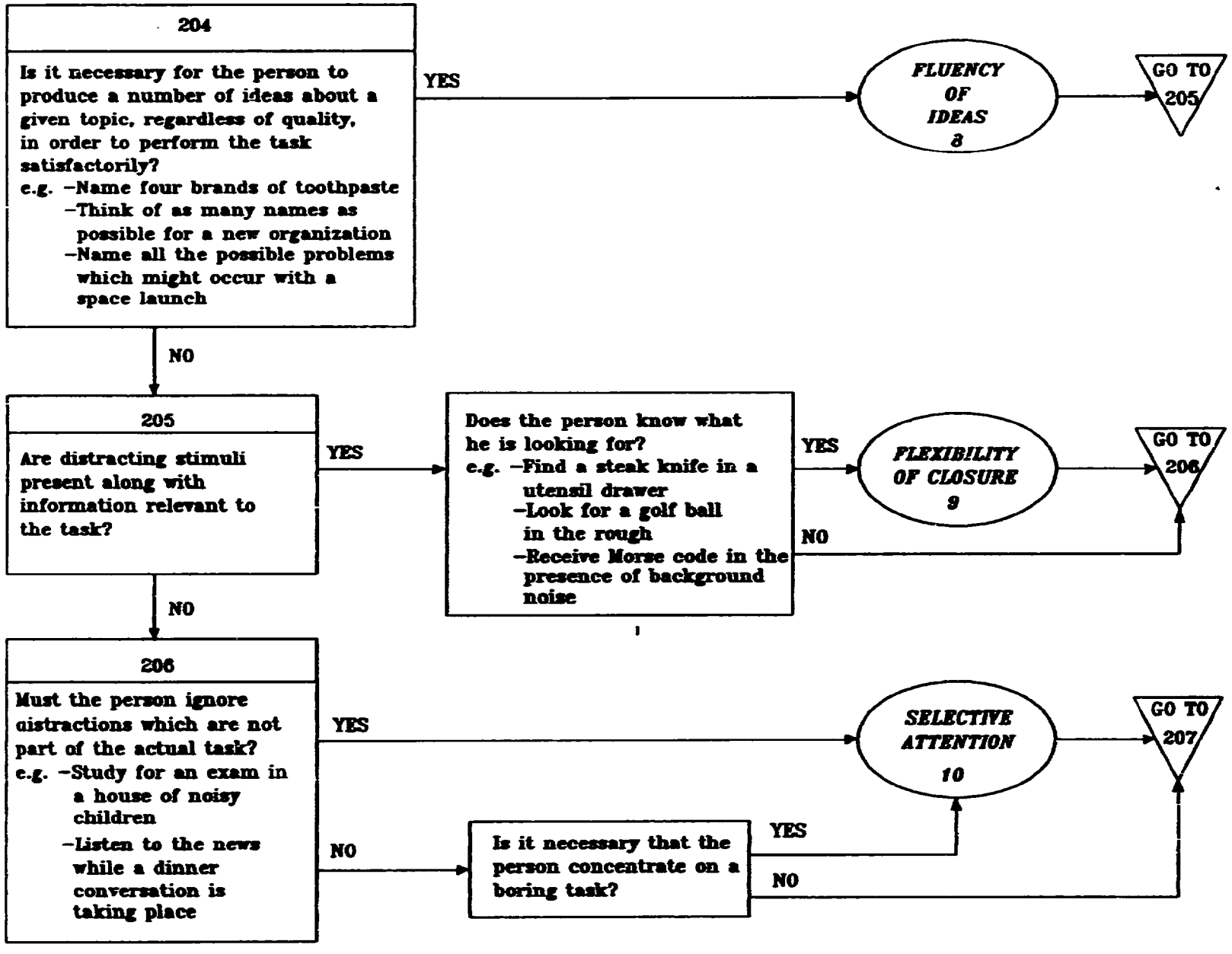
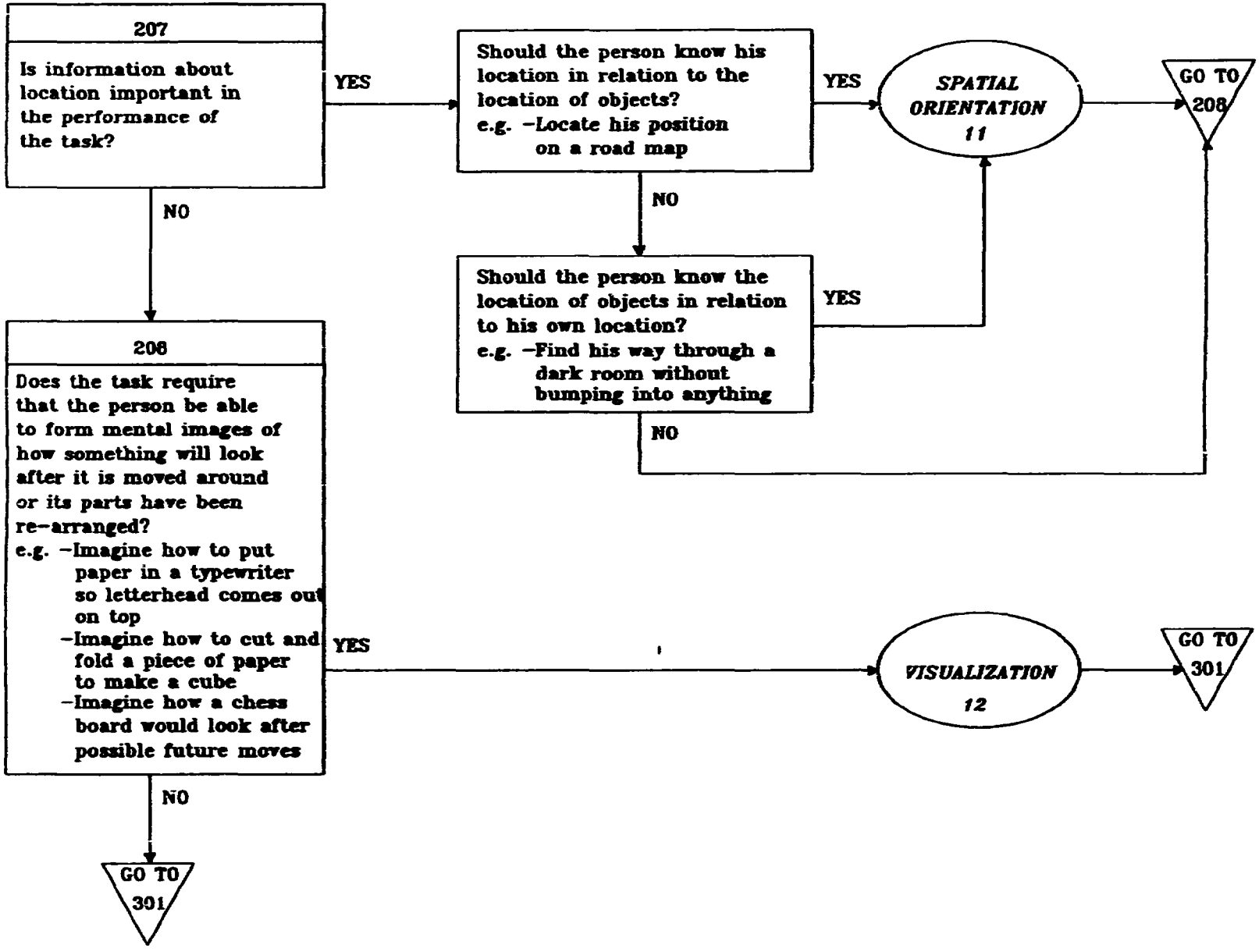
Appendix A

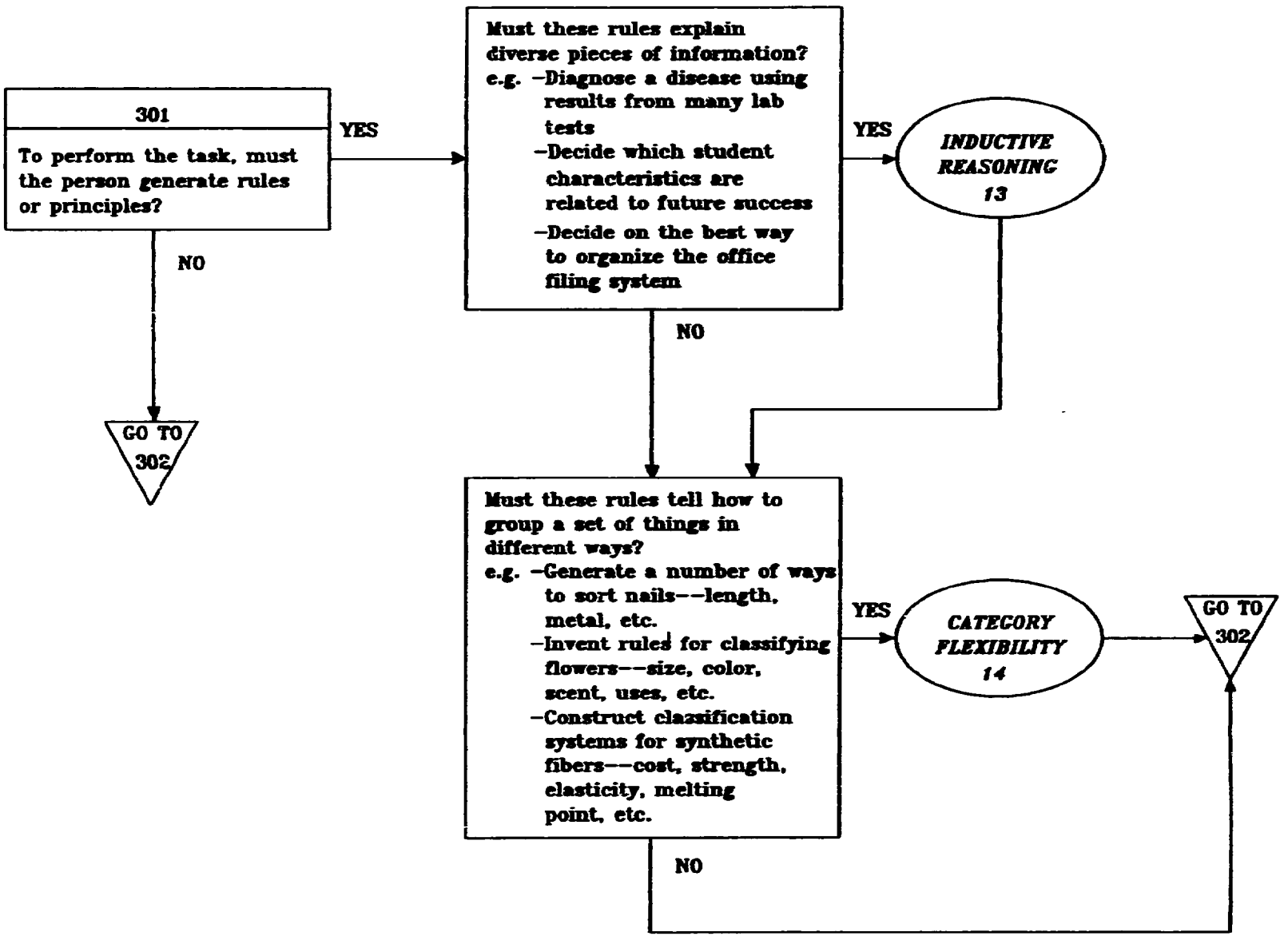
JCAT Part A Decision Flow Diagrams

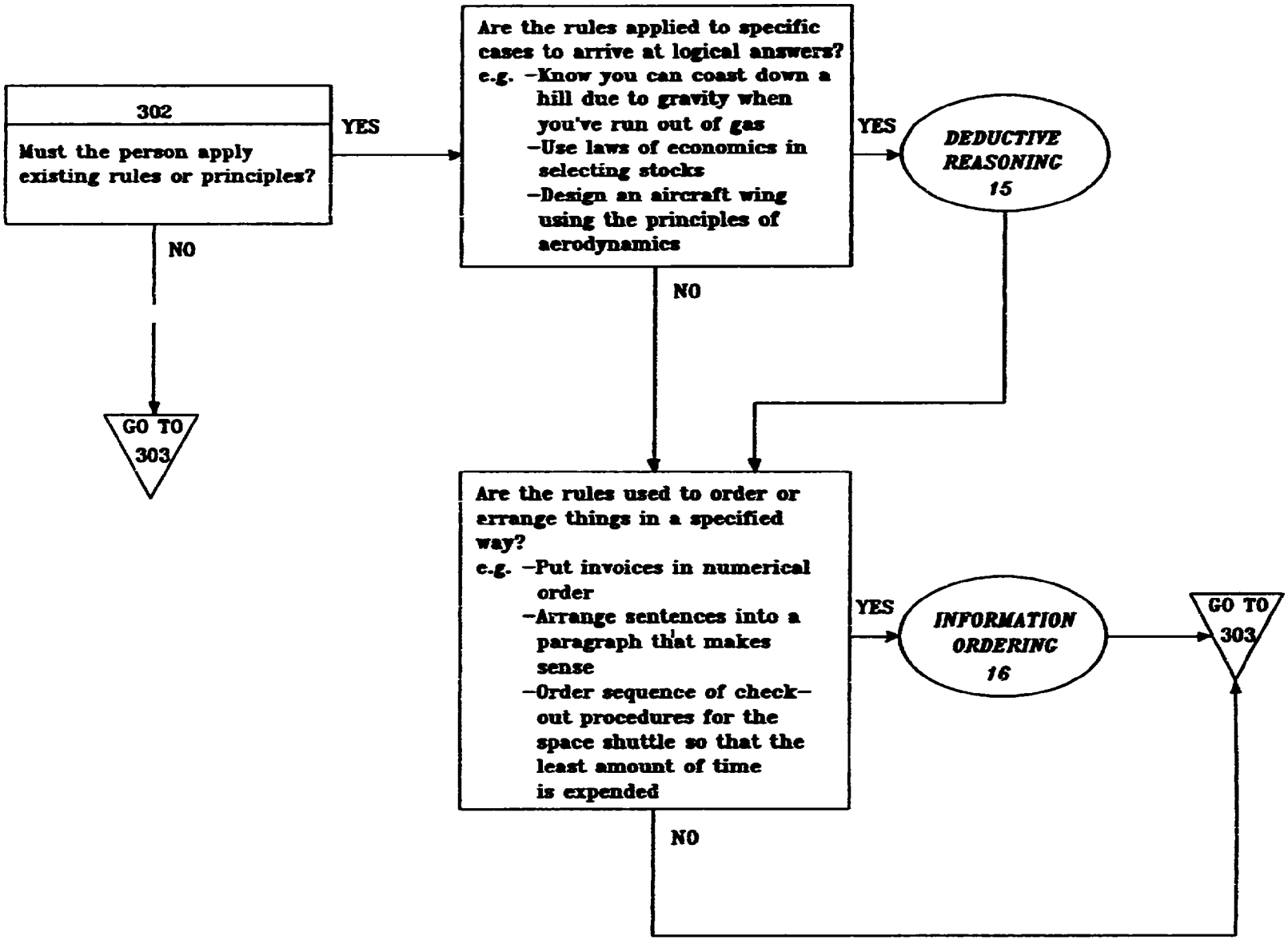

START
101
In order to perform the task, is it necessary that the person know and use language?
YES
Is it necessary to listen to and understand spoken words and sentences?
YES
ORAL COMPREHENSION 1
NO
NO
GO TO 201
Is it necessary to read and understand written words, sentences, and paragraphs?
YES
WRITTEN COMPREHENSION 2
GO TO 102
NO
102
Assuming that the person is knowledgeable about a subject or topic, must he communicate that knowledge to others?
YES
Must he communicate through speaking so that others will understand his information?
YES
ORAL EXPRESSION 3
NO
NO
Must he communicate through writing so that others will understand his information?
YES
WRITTEN EXPRESSION 4
GO TO 201
NO
GO TO 201

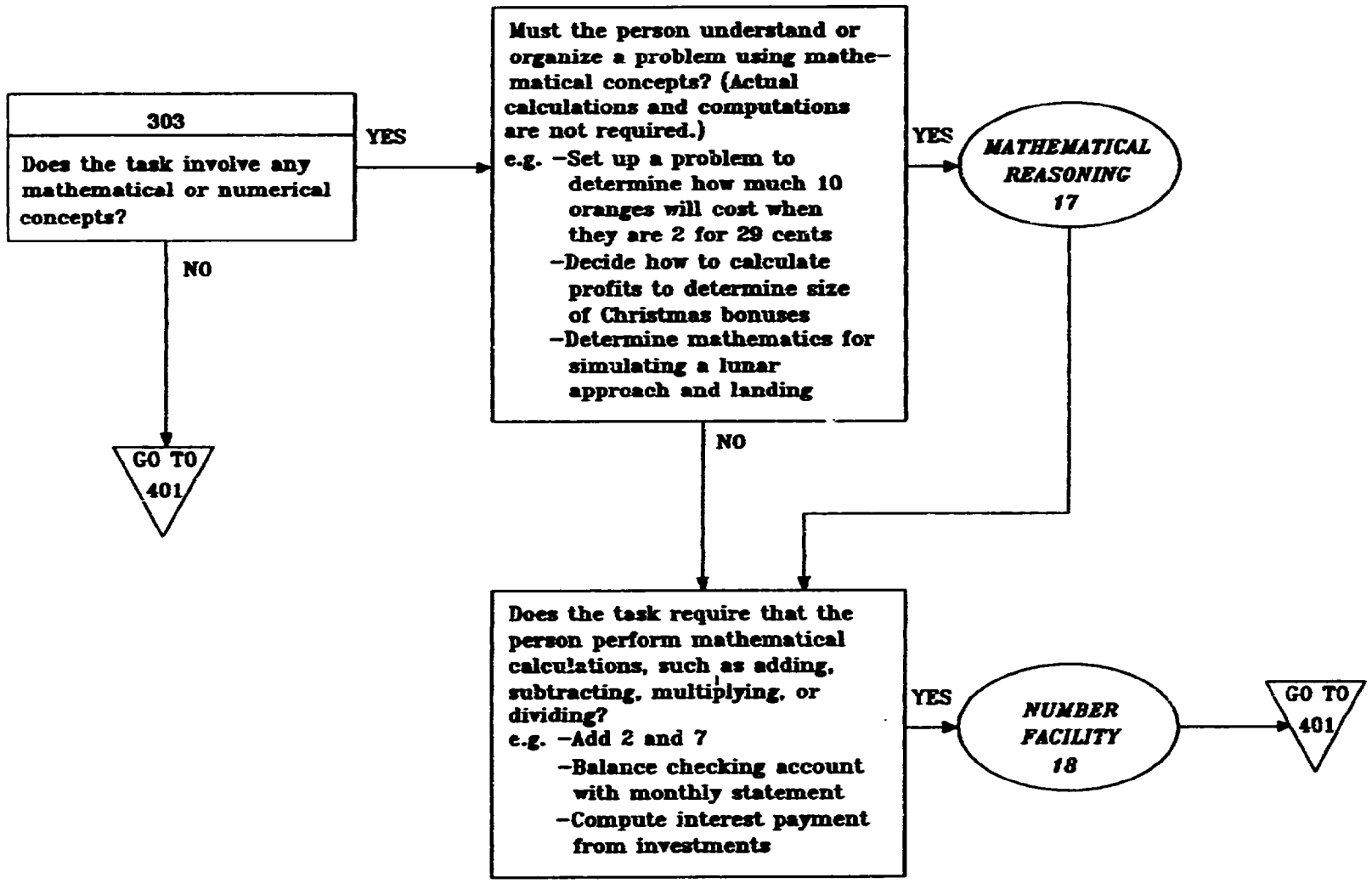

201
Must the person be able to remember or memorize words, numbers, pictures, procedures, or other things?
YES
MEMORIZATION
5
GO TO
202
NO
202
Can problems, mistakes or malfunctions occur in this task or as a part of the task?
e.g. -Machine isn't operating correctly
YES
Is it important that these problems are recognized by the person performing the task?
e.g. -Seamstress notices machine stitches are too tight
-Teacher recognizes child has a hearing problem
-Proofreader finds typing errors
YES
PROBLEM SENSITIVITY
6
GO TO
203
NO
NO
203
Does the task require the person to be creative?
e.g. -Develop new procedures where standard procedures are not applicable or not working well
-Produce unusual and clever ideas on a topic or situation
-Create novel solutions to problems
YES
ORIGINALITY
7
GO TO
204
NO

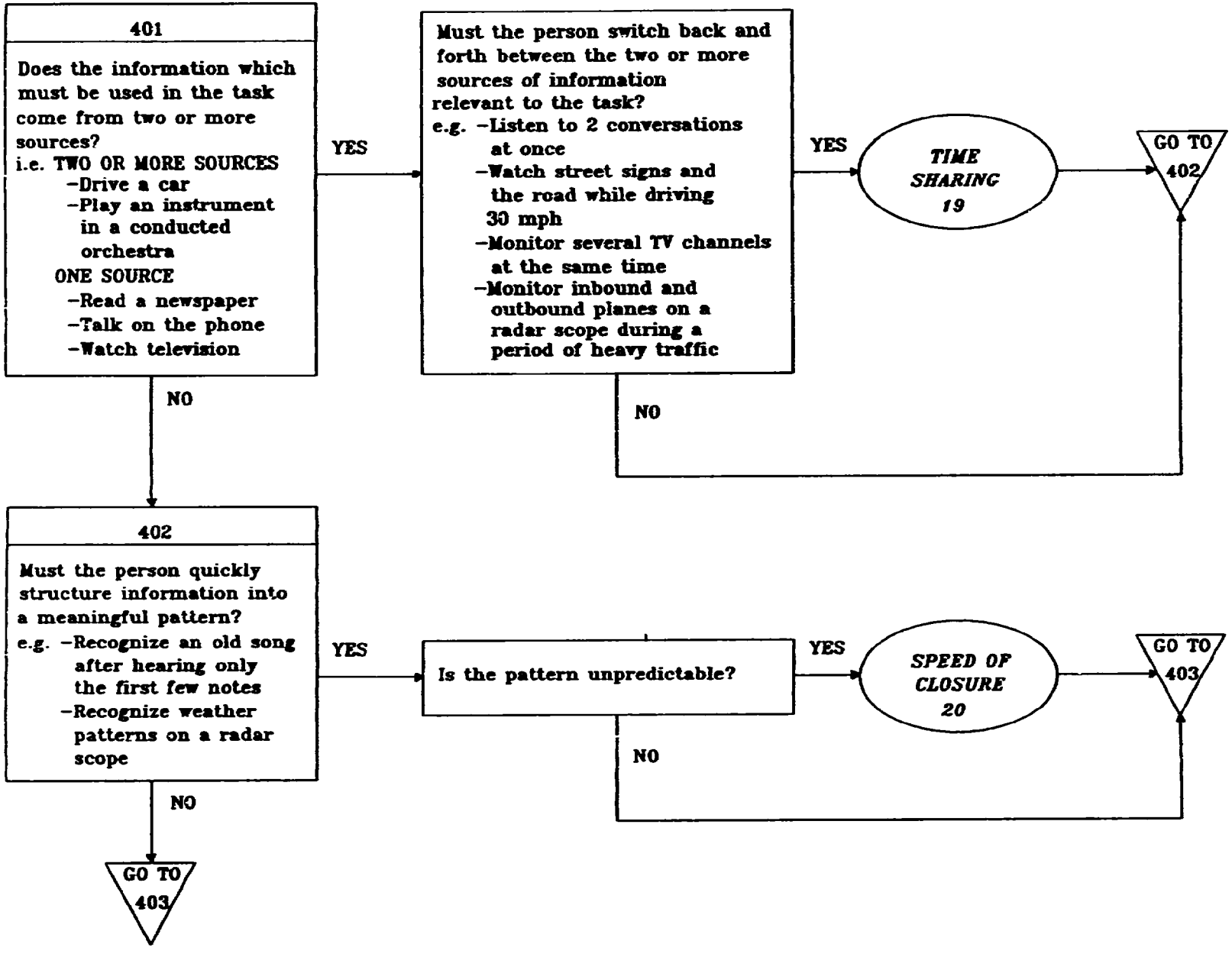

204
Is it necessary for the person to produce a number of ideas about a given topic, regardless of quality, in order to perform the task satisfactorily?
e.g. –Name four brands of toothpaste
–Think of as many names as possible for a new organization
–Name all the possible problems which might occur with a space launch
YES
FLUENCY OF IDEAS 8
GO TO 205
NO
205
Are distracting stimuli present along with information relevant to the task?
YES
Does the person know what he is looking for?
e.g. –Find a steak knife in a utensil drawer
–Look for a golf ball in the rough
–Receive Morse code in the presence of background noise
YES
FLEXIBILITY OF CLOSURE 9
GO TO 206
NO
NO
206
Must the person ignore distractions which are not part of the actual task?
e.g. –Study for an exam in a house of noisy children
–Listen to the news while a dinner conversation is taking place
YES
SELECTIVE ATTENTION 10
GO TO 207
NO
Is it necessary that the person concentrate on a boring task?
YES
NO

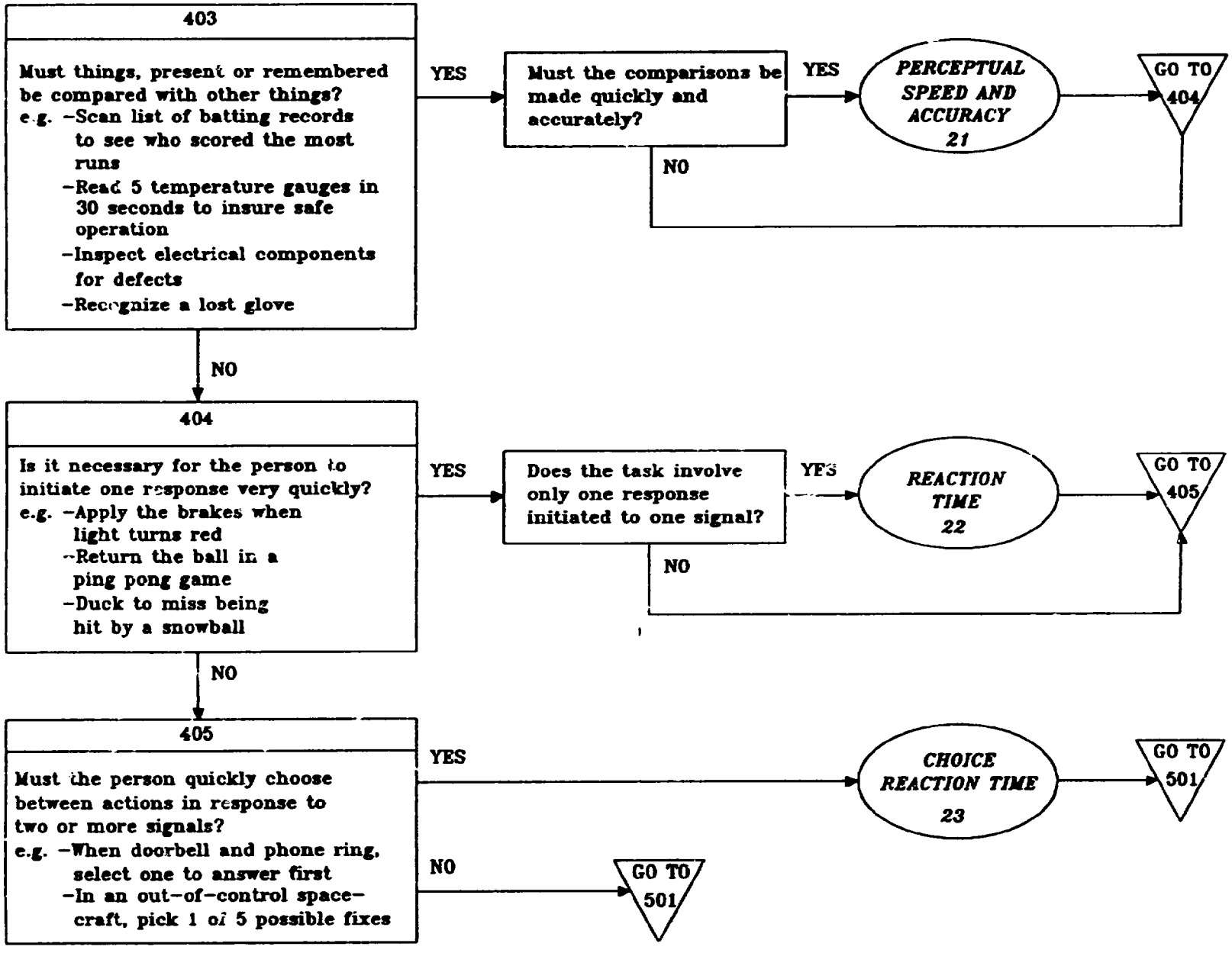

207
Is information about location important in the performance of the task?
YES
Should the person know his location in relation to the location of objects?
e.g. -Locate his position on a road map
YES
SPATIAL ORIENTATION 11
GO TO 208
NO
Should the person know the location of objects in relation to his own location?
e.g. -Find his way through a dark room without bumping into anything
YES
NO
208
Does the task require that the person be able to form mental images of how something will look after it is moved around or its parts have been re-arranged?
e.g. -Imagine how to put paper in a typewriter so letterhead comes out on top
-Imagine how to cut and fold a piece of paper to make a cube
-Imagine how a chess board would look after possible future moves
YES
VISUALIZATION 12
GO TO 301
NO
GO TO 301

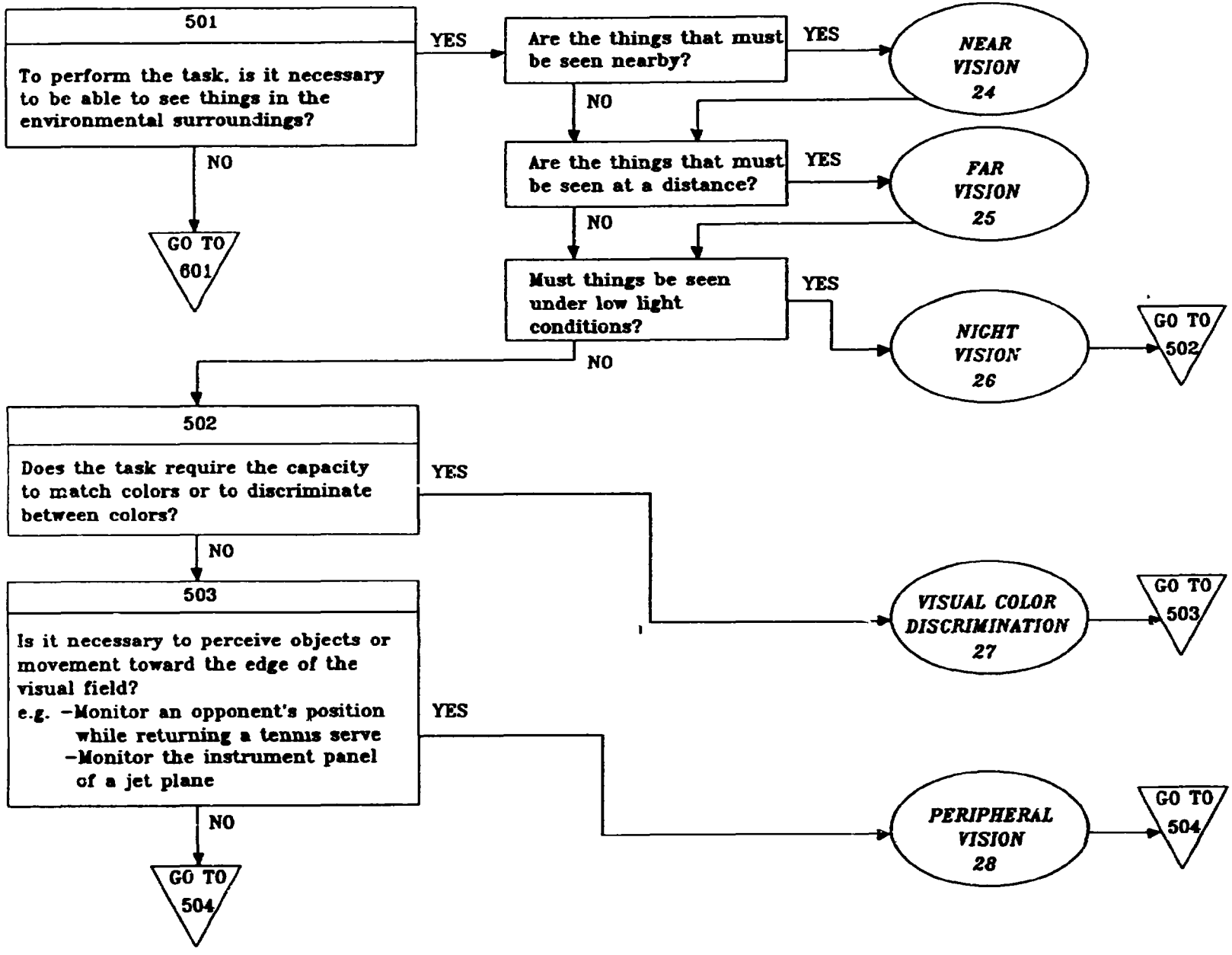

301
To perform the task, must the person generate rules or principles?
YES
NO
GO TO 302
Must these rules explain diverse pieces of information?
e.g. –Diagnose a disease using results from many lab tests
–Decide which student characteristics are related to future success
–Decide on the best way to organize the office filing system
YES
INDUCTIVE REASONING 13
NO
Must these rules tell how to group a set of things in different ways?
e.g. –Generate a number of ways to sort nails––length, metal, etc.
–Invent rules for classifying flowers––size, color, scent, uses, etc.
–Construct classification systems for synthetic fibers––cost, strength, elasticity, melting point, etc.
YES
CATEGORY FLEXIBILITY 14
GO TO 302
NO

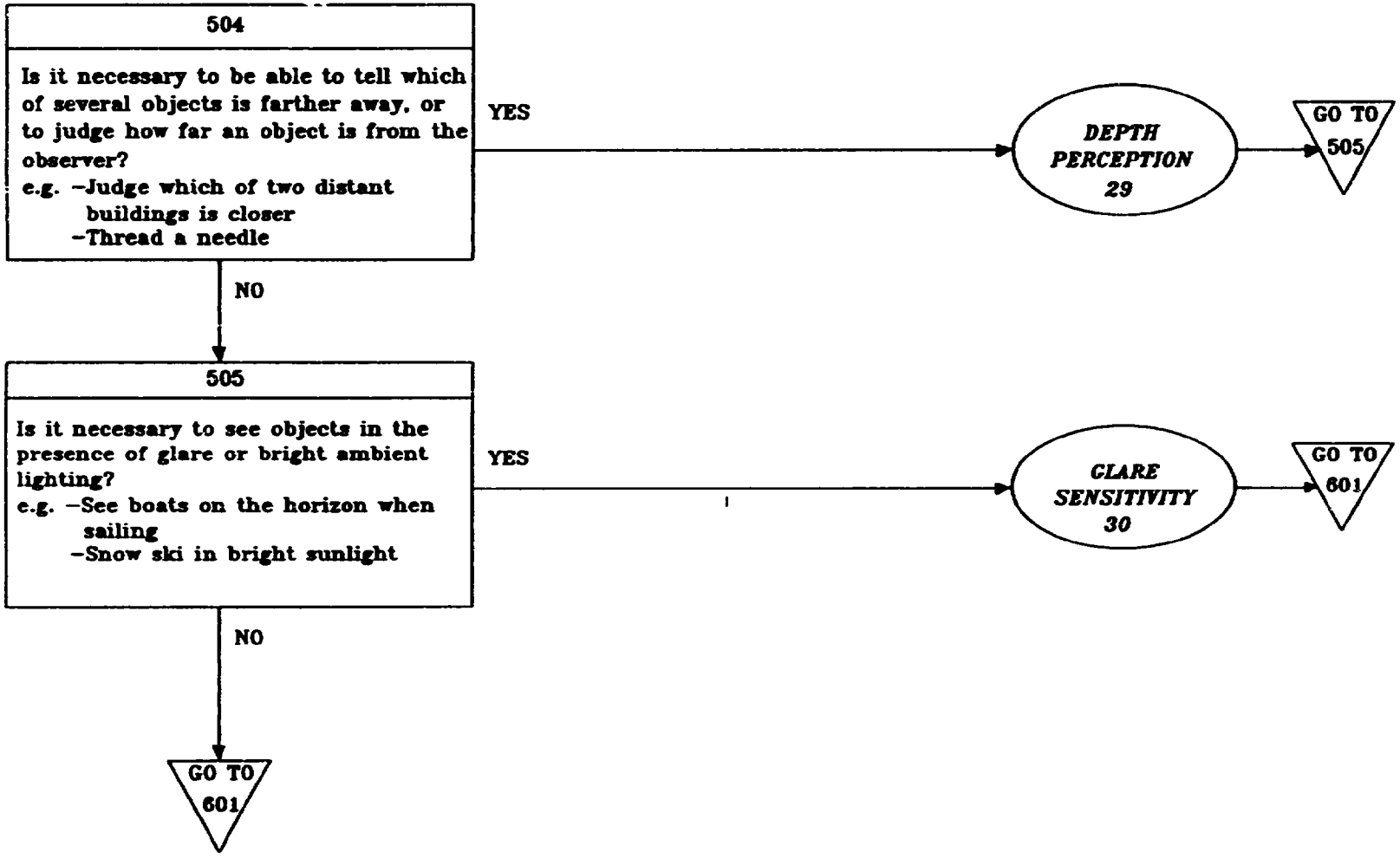

302
Must the person apply existing rules or principles?
YES
NO
GO TO 303
Are the rules applied to specific cases to arrive at logical answers?
e.g. –Know you can coast down a hill due to gravity when you've run out of gas
–Use laws of economics in selecting stocks
–Design an aircraft wing using the principles of aerodynamics
YES
DEDUCTIVE REASONING 15
NO
Are the rules used to order or arrange things in a specified way?
e.g. –Put invoices in numerical order
–Arrange sentences into a paragraph that makes sense
–Order sequence of check–out procedures for the space shuttle so that the least amount of time is expended
YES
INFORMATION ORDERING 16
GO TO 303
NO

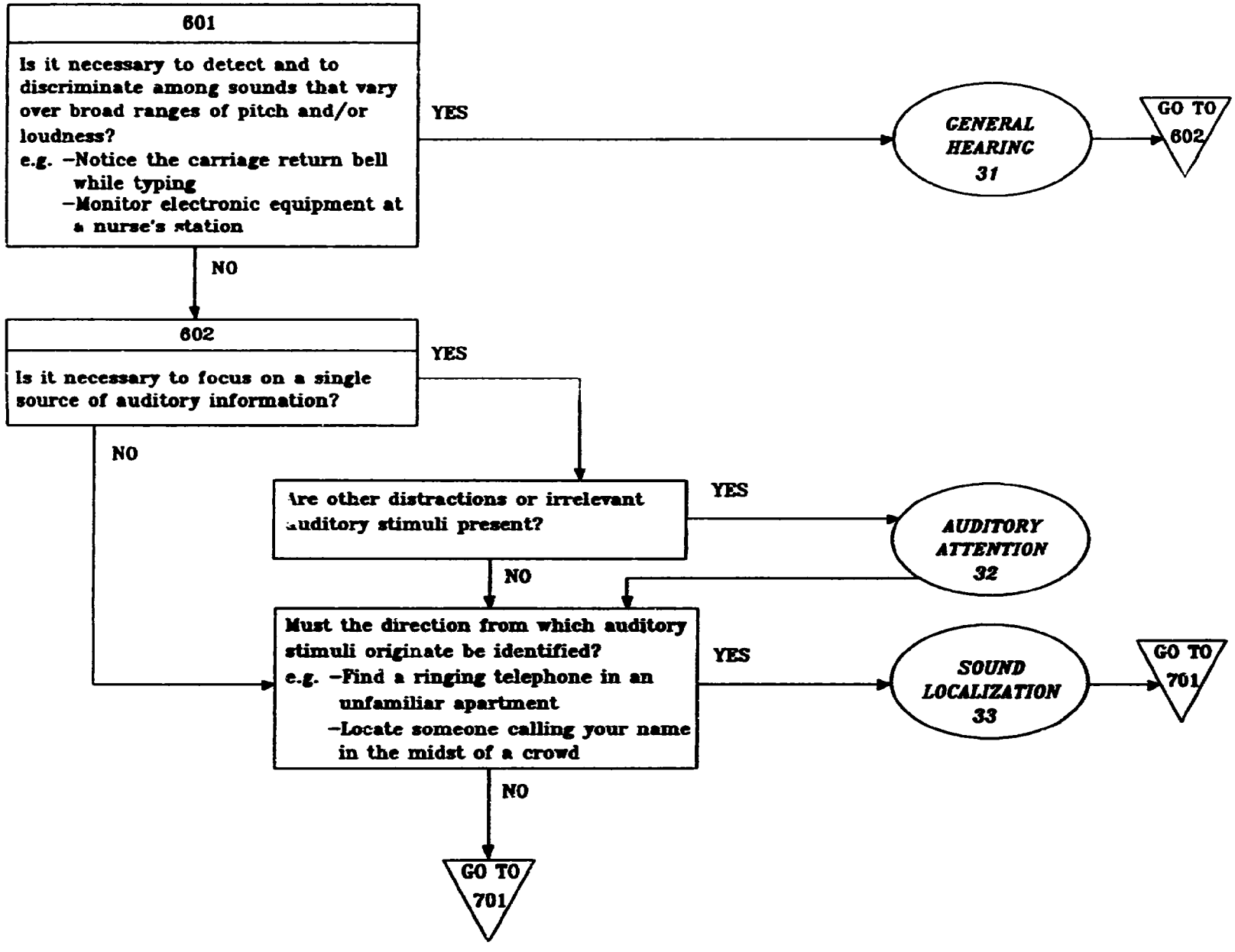

303
Does the task involve any mathematical or numerical concepts?
YES
NO
GO TO 401
Must the person understand or organize a problem using mathematical concepts? (Actual calculations and computations are not required.)
e.g. –Set up a problem to determine how much 10 oranges will cost when they are 2 for 29 cents
–Decide how to calculate profits to determine size of Christmas bonuses
–Determine mathematics for simulating a lunar approach and landing
YES
MATHEMATICAL REASONING 17
NO
Does the task require that the person perform mathematical calculations, such as adding, subtracting, multiplying, or dividing?
e.g. –Add 2 and 7
–Balance checking account with monthly statement
–Compute interest payment from investments
YES
NUMBER FACILITY 18
GO TO 401

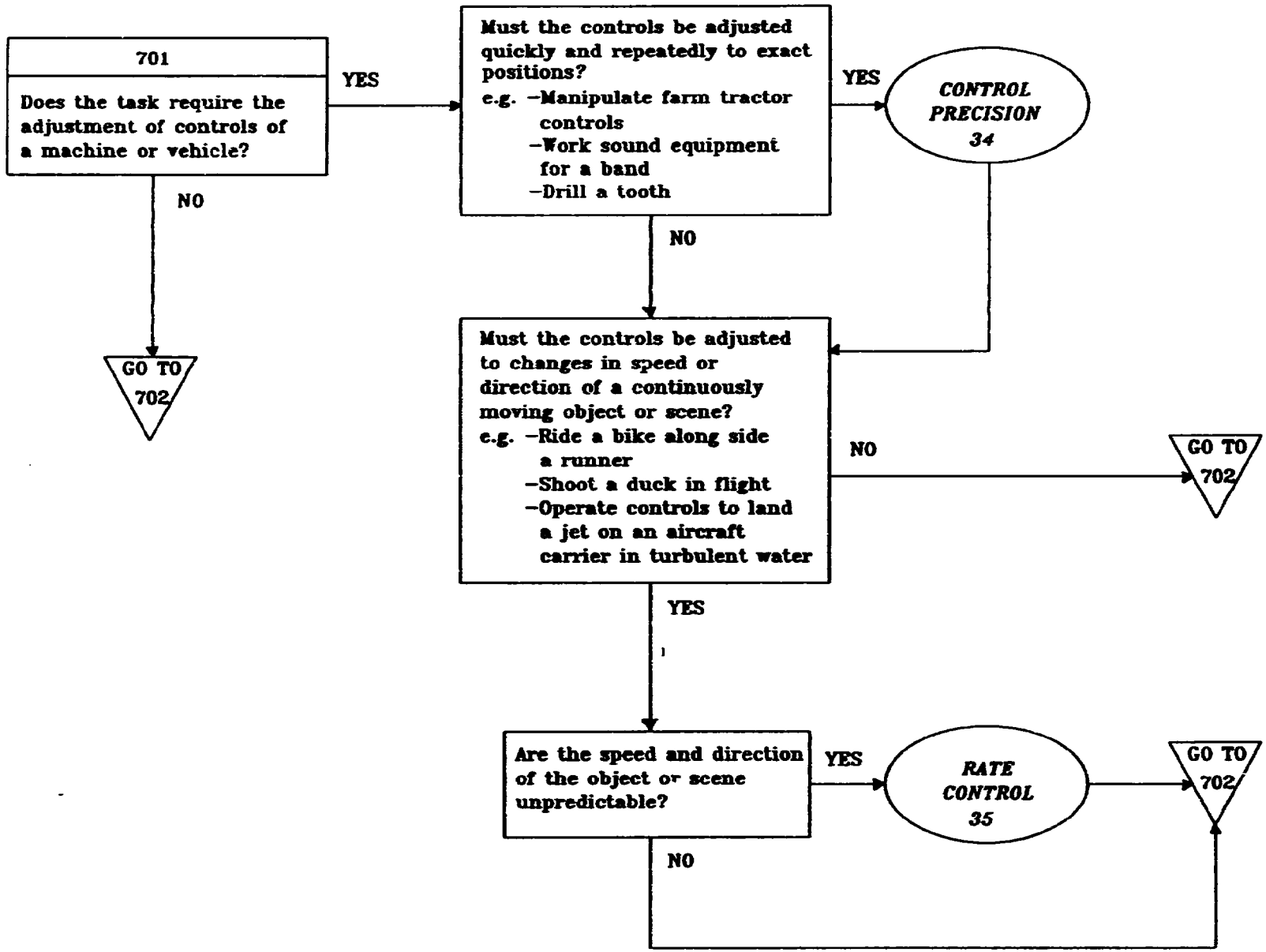

401
Does the information which must be used in the task come from two or more sources?
i.e. TWO OR MORE SOURCES
-Drive a car
-Play an instrument in a conducted orchestra
ONE SOURCE
-Read a newspaper
-Talk on the phone
-Watch television
YES
Must the person switch back and forth between the two or more sources of information relevant to the task?
e.g. -Listen to 2 conversations at once
-Watch street signs and the road while driving 30 mph
-Monitor several TV channels at the same time
-Monitor inbound and outbound planes on a radar scope during a period of heavy traffic
YES
TIME SHARING 19
GO TO 402
NO
NO
402
Must the person quickly structure information into a meaningful pattern?
e.g. -Recognize an old song after hearing only the first few notes
-Recognize weather patterns on a radar scope
YES
Is the pattern unpredictable?
YES
SPEED OF CLOSURE 20
GO TO 403
NO
NO
GO TO 403

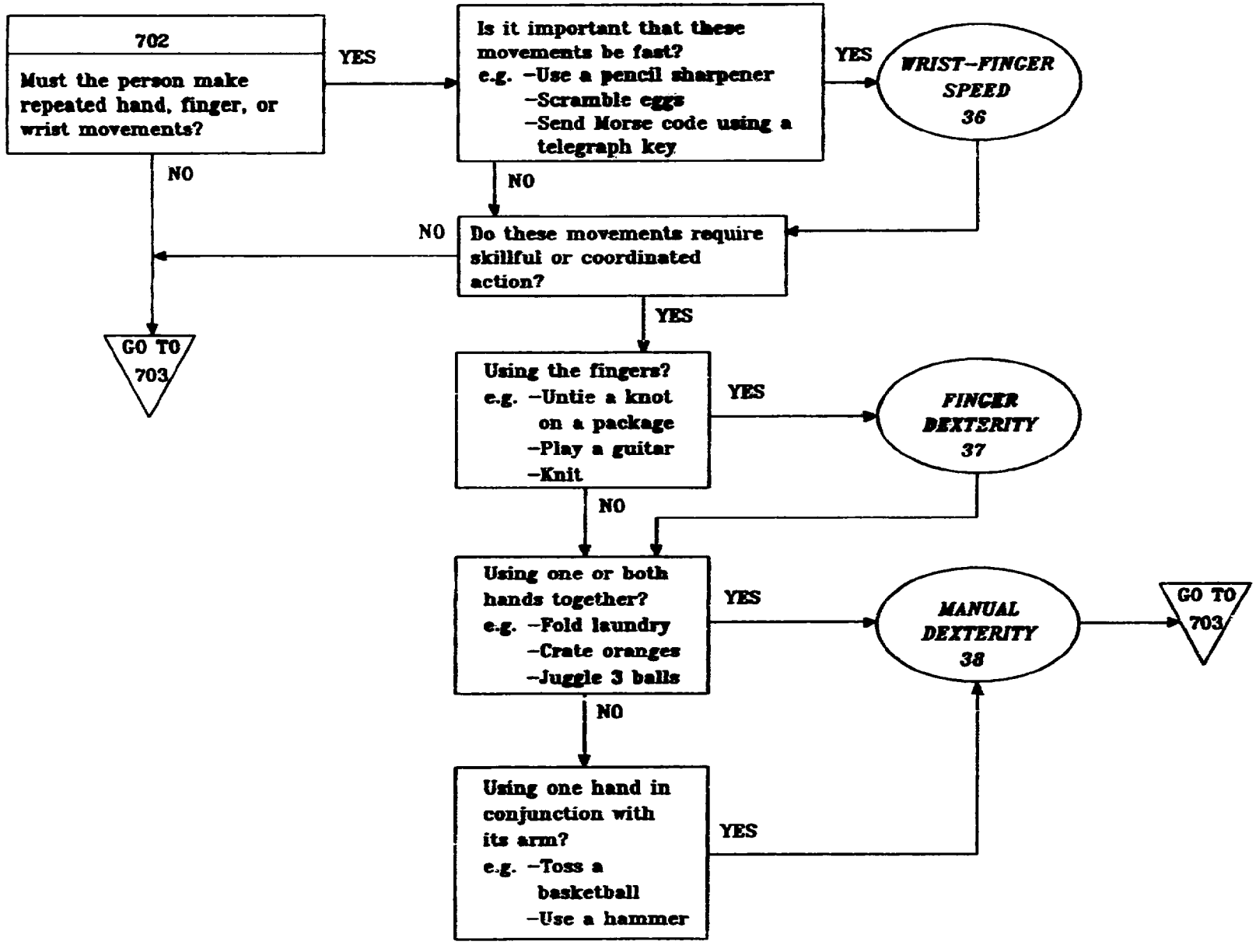

403
Must things, present or remembered be compared with other things?
e.g. -Scan list of batting records to see who scored the most runs
-Read 5 temperature gauges in 30 seconds to insure safe operation
-Inspect electrical components for defects
-Recognize a lost glove
YES
Must the comparisons be made quickly and accurately?
YES
PERCEPTUAL SPEED AND ACCURACY 21
GO TO 404
NO
NO
404
Is it necessary for the person to initiate one response very quickly?
e.g. -Apply the brakes when light turns red
-Return the ball in a ping pong game
-Duck to miss being hit by a snowball
YES
Does the task involve only one response initiated to one signal?
YES
REACTION TIME 22
GO TO 405
NO
NO
405
Must the person quickly choose between actions in response to two or more signals?
e.g. -When doorbell and phone ring, select one to answer first
-In an out-of-control space-craft, pick 1 of 5 possible fixes
YES
CHOICE REACTION TIME 23
GO TO 501
NO
GO TO 501

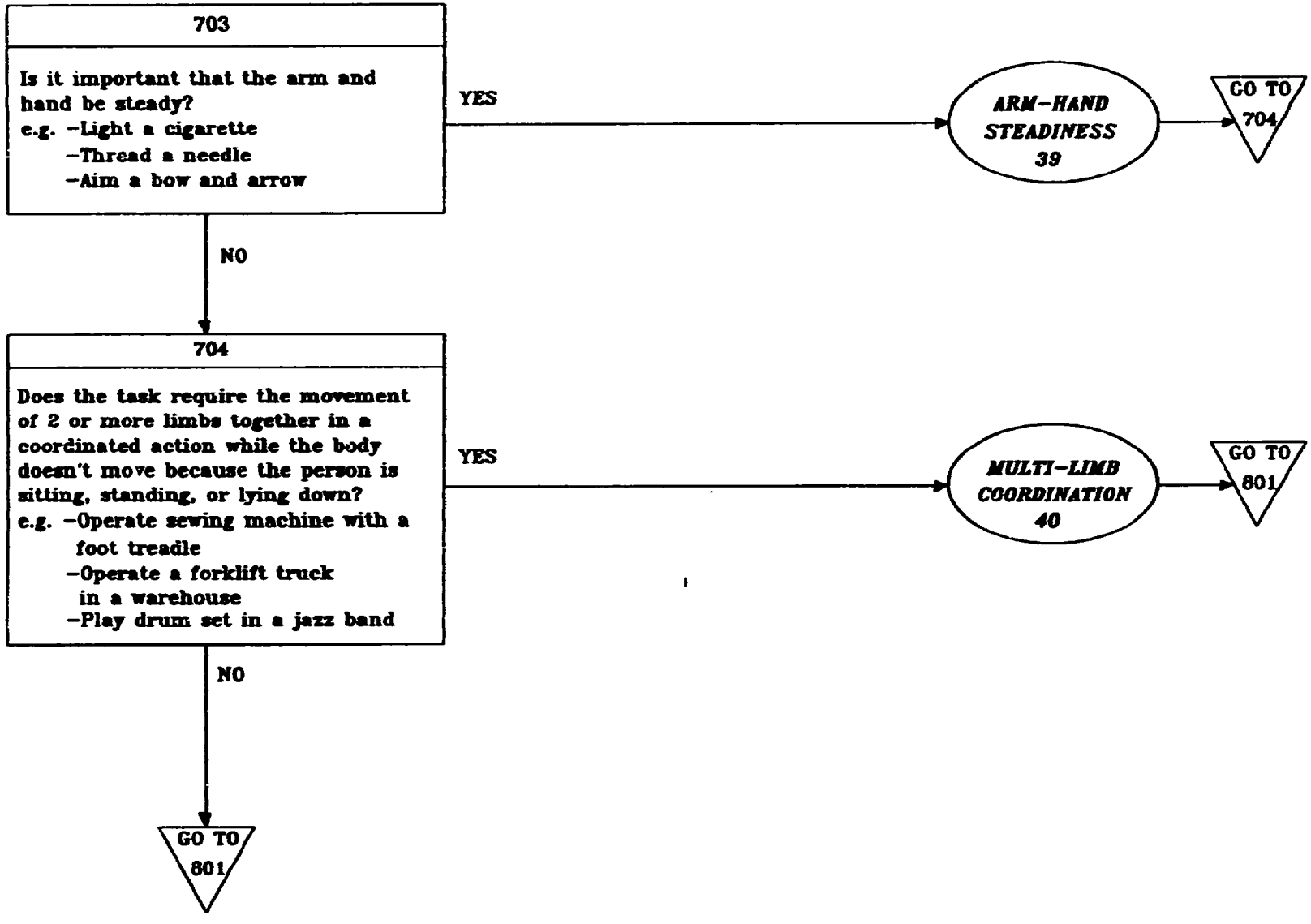

501
To perform the task, is it necessary to be able to see things in the environmental surroundings?
YES
NO
GO TO 601
Are the things that must be seen nearby?
YES
NO
NEAR VISION 24
Are the things that must be seen at a distance?
YES
NO
FAR VISION 25
Must things be seen under low light conditions?
YES
NO
NIGHT VISION 26
GO TO 502
502
Does the task require the capacity to match colors or to discriminate between colors?
YES
NO
VISUAL COLOR DISCRIMINATION 27
GO TO 503
503
Is it necessary to perceive objects or movement toward the edge of the visual field?
e.g. -Monitor an opponent's position while returning a tennis serve
-Monitor the instrument panel of a jet plane
YES
NO
PERIPHERAL VISION 28
GO TO 504
GO TO 504

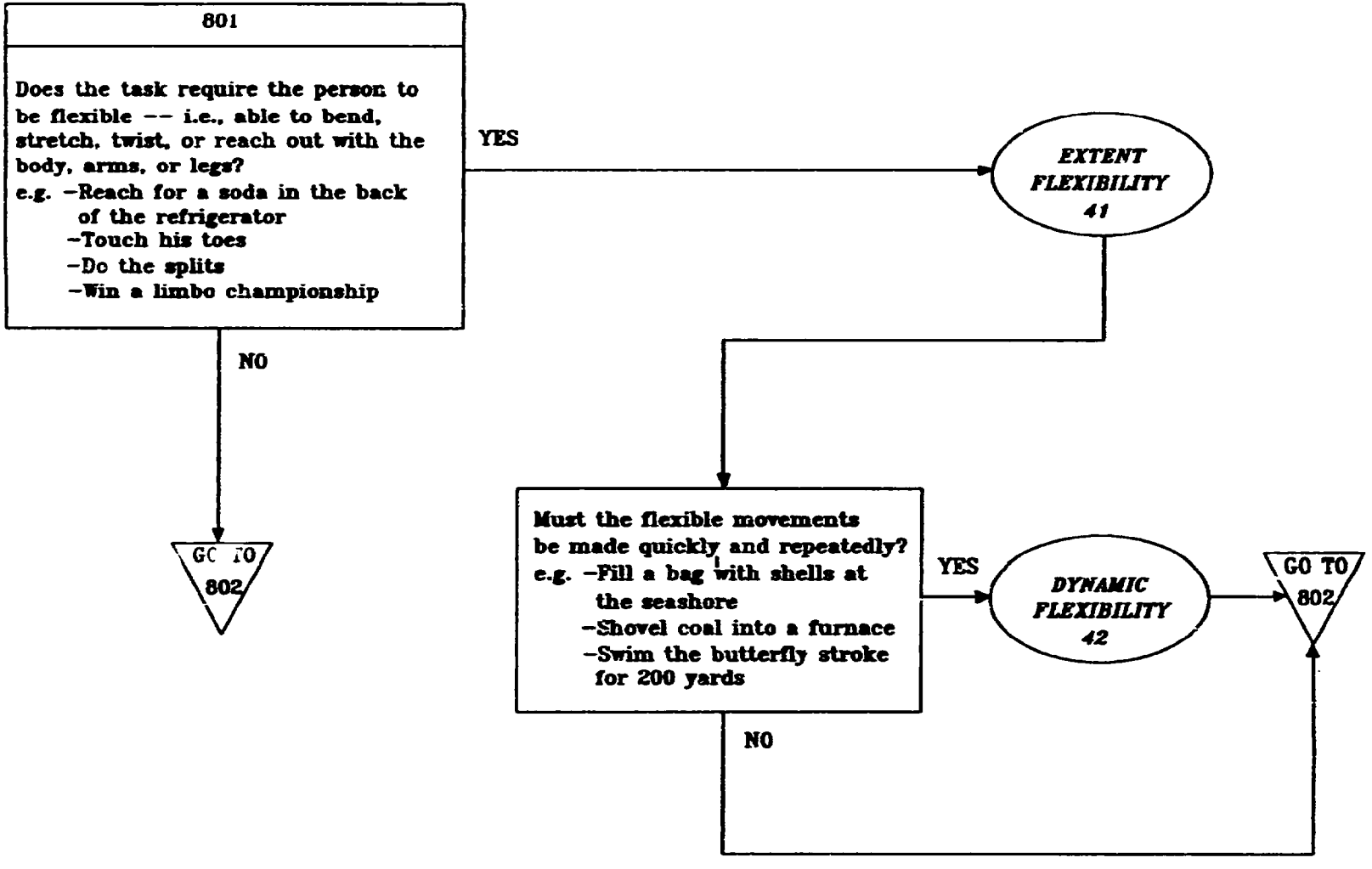

504
Is it necessary to be able to tell which of several objects is farther away, or to judge how far an object is from the observer?
e.g. –Judge which of two distant buildings is closer
–Thread a needle
YES
DEPTH PERCEPTION 29
GO TO 505
NO
505
Is it necessary to see objects in the presence of glare or bright ambient lighting?
e.g. –See boats on the horizon when sailing
–Snow ski in bright sunlight
YES
GLARE SENSITIVITY 30
GO TO 601
NO
GO TO 601

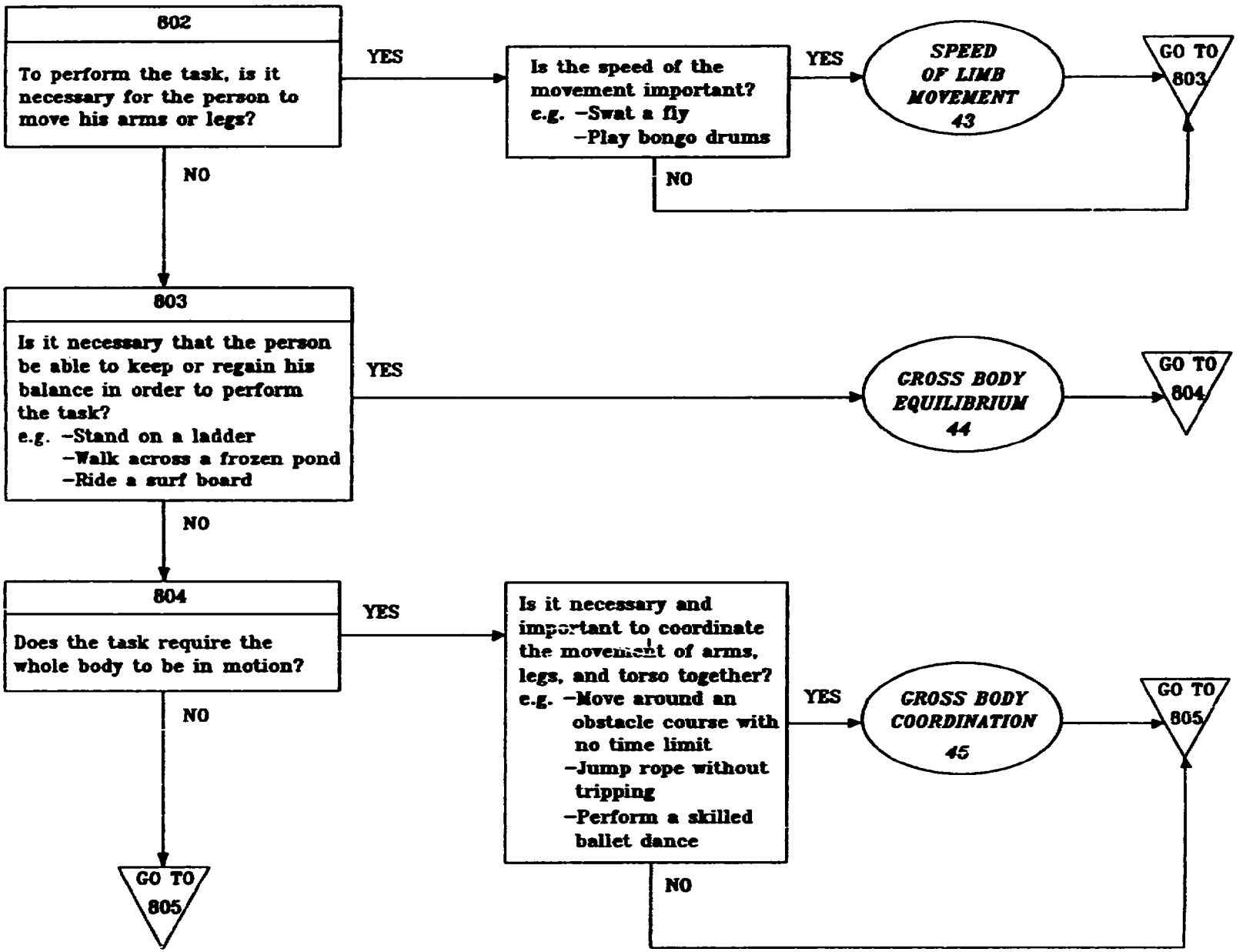

601
Is it necessary to detect and to discriminate among sounds that vary over broad ranges of pitch and/or loudness?
e.g. –Notice the carriage return bell while typing
–Monitor electronic equipment at a nurse's station
YES
GENERAL HEARING 31
GO TO 602
NO
602
Is it necessary to focus on a single source of auditory information?
YES
NO
Are other distractions or irrelevant auditory stimuli present?
YES
AUDITORY ATTENTION 32
NO
Must the direction from which auditory stimuli originate be identified?
e.g. –Find a ringing telephone in an unfamiliar apartment
–Locate someone calling your name in the midst of a crowd
YES
SOUND LOCALIZATION 33
GO TO 701
NO
GO TO 701

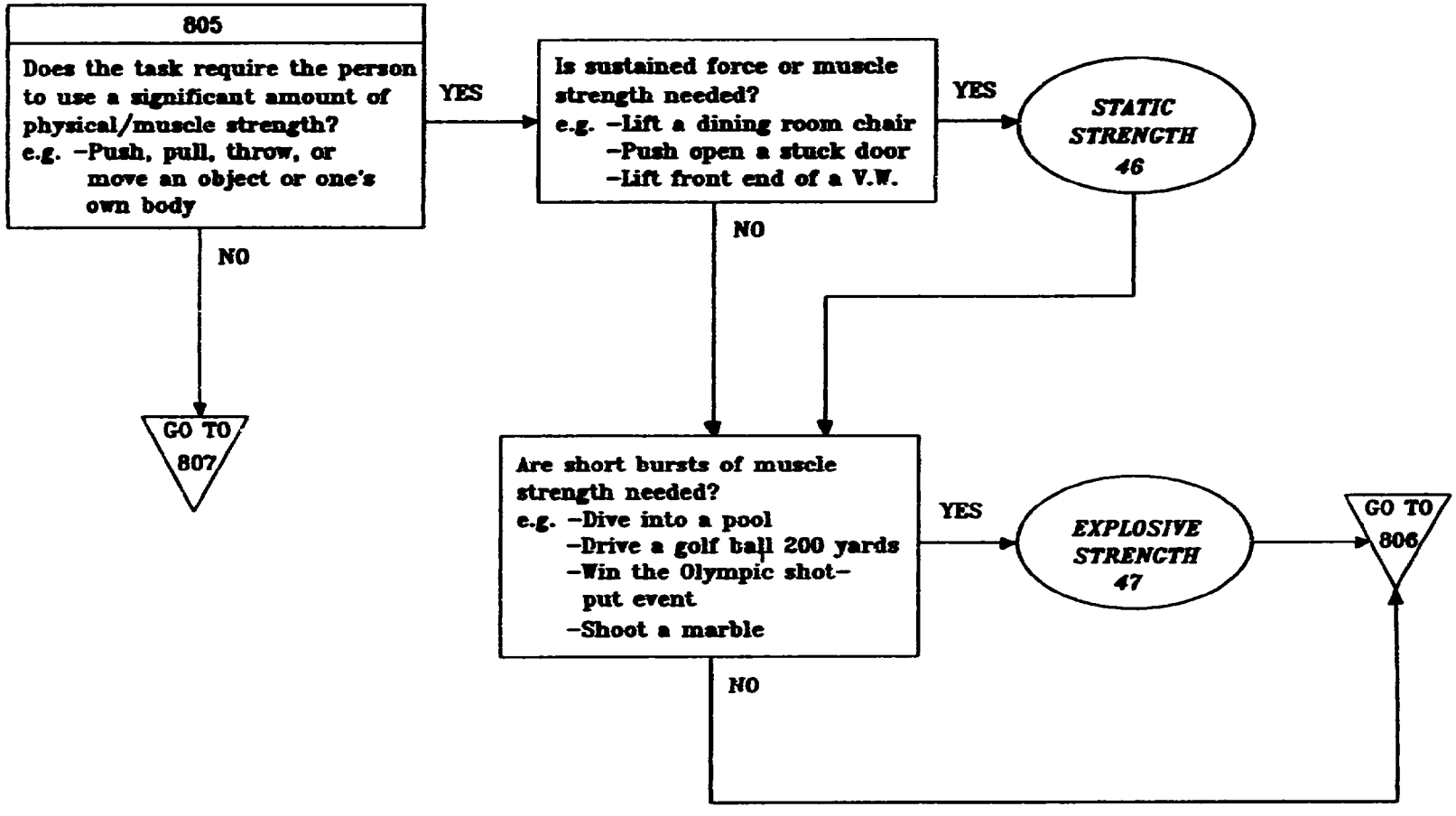

701
Does the task require the adjustment of controls of a machine or vehicle?
YES
NO
GO TO 702
Must the controls be adjusted quickly and repeatedly to exact positions?
e.g. –Manipulate farm tractor controls
–Work sound equipment for a band
–Drill a tooth
YES
CONTROL PRECISION 34
NO
Must the controls be adjusted to changes in speed or direction of a continuously moving object or scene?
e.g. –Ride a bike along side a runner
–Shoot a duck in flight
–Operate controls to land a jet on an aircraft carrier in turbulent water
NO
GO TO 702
YES
Are the speed and direction of the object or scene unpredictable?
YES
RATE CONTROL 35
GO TO 702
NO

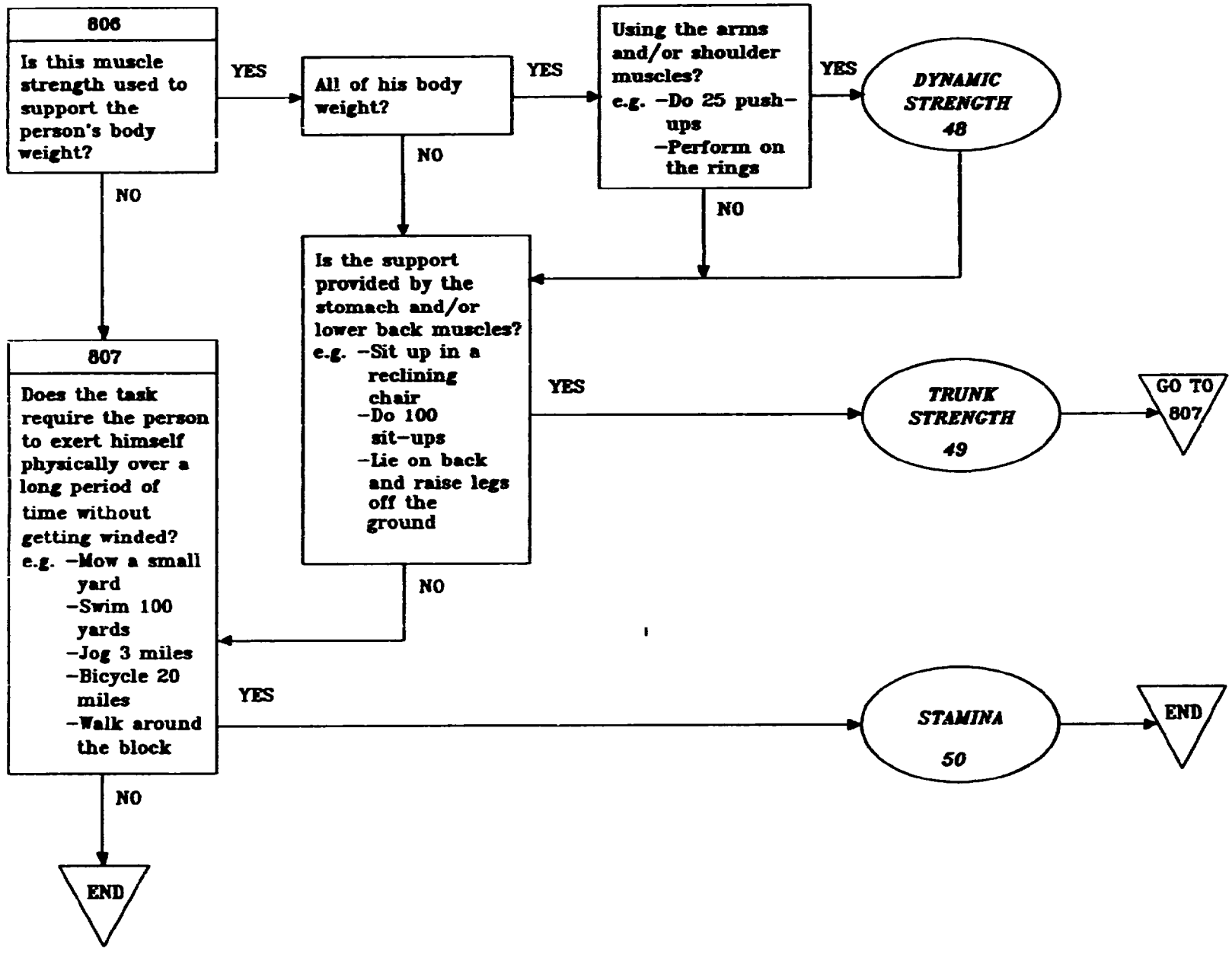

702
Must the person make repeated hand, finger, or wrist movements?
YES
Is it important that these movements be fast?
e.g. –Use a pencil sharpener
–Scramble eggs
–Send Morse code using a telegraph key
YES
WRIST–FINGER SPEED
36
NO
NO
Do these movements require skillful or coordinated action?
NO
GO TO 703
YES
Using the fingers?
e.g. –Untie a knot on a package
–Play a guitar
–Knit
YES
FINGER DEXTERITY
37
NO
Using one or both hands together?
e.g. –Fold laundry
–Crate oranges
–Juggle 3 balls
YES
MANUAL DEXTERITY
38
GO TO 703
NO
Using one hand in conjunction with its arm?
e.g. –Toss a basketball
–Use a hammer
YES


703
Is it important that the arm and hand be steady?
e.g. –Light a cigarette
–Thread a needle
–Aim a bow and arrow
YES
ARM–HAND STEADINESS 39
GO TO 704
NO
704
Does the task require the movement of 2 or more limbs together in a coordinated action while the body doesn't move because the person is sitting, standing, or lying down?
e.g. –Operate sewing machine with a foot treadle
–Operate a forklift truck in a warehouse
–Play drum set in a jazz band
YES
MULTI–LIMB COORDINATION 40
GO TO 801
NO
GO TO 801


801
Does the task require the person to be flexible -- i.e., able to bend, stretch, twist, or reach out with the body, arms, or legs?
e.g. -Reach for a soda in the back of the refrigerator
-Touch his toes
-Do the splits
-Win a limbo championship
YES
EXTENT FLEXIBILITY 41
NO
GO TO 802
Must the flexible movements be made quickly and repeatedly?
e.g. -Fill a bag with shells at the seashore
-Shovel coal into a furnace
-Swim the butterfly stroke for 200 yards
YES
DYNAMIC FLEXIBILITY 42
GO TO 802
NO


802
To perform the task, is it necessary for the person to move his arms or legs?
YES
Is the speed of the movement important?
e.g. –Swat a fly
–Play bongo drums
YES
SPEED OF LIMB MOVEMENT 43
GO TO 803
NO
NO
803
Is it necessary that the person be able to keep or regain his balance in order to perform the task?
e.g. –Stand on a ladder
–Walk across a frozen pond
–Ride a surf board
YES
CROSS BODY EQUILIBRIUM 44
GO TO 804
NO
804
Does the task require the whole body to be in motion?
YES
Is it necessary and important to coordinate the movement of arms, legs, and torso together?
e.g. –Move around an obstacle course with no time limit
–Jump rope without tripping
–Perform a skilled ballet dance
YES
CROSS BODY COORDINATION 45
GO TO 805
NO
NO
GO TO 805

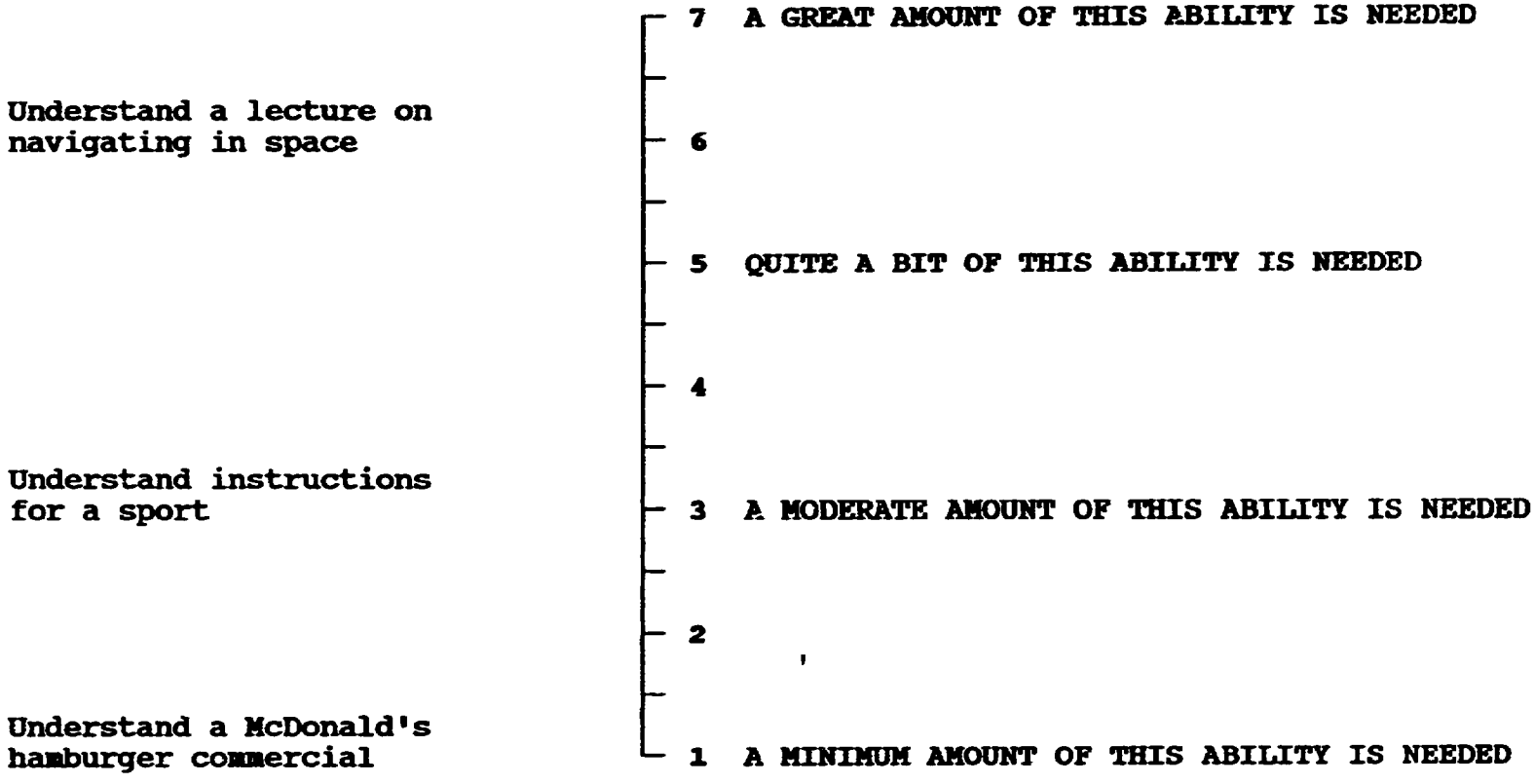

805
Does the task require the person to use a significant amount of physical/muscle strength?
e.g. -Push, pull, throw, or move an object or one's own body
YES
Is sustained force or muscle strength needed?
e.g. -Lift a dining room chair
-Push open a stuck door
-Lift front end of a V.W.
YES
STATIC STRENGTH 46
NO
NO
GO TO 807
Are short bursts of muscle strength needed?
e.g. -Dive into a pool
-Drive a golf ball 200 yards
-Win the Olympic shot-put event
-Shoot a marble
YES
EXPLOSIVE STRENGTH 47
GO TO 806
NO


806
Is this muscle strength used to support the person's body weight?
YES
All of his body weight?
YES
Using the arms and/or shoulder muscles?
e.g. -Do 25 push-ups
-Perform on the rings
YES
DYNAMIC STRENGTH 48
NO
NO
Is the support provided by the stomach and/or lower back muscles?
e.g. -Sit up in a reclining chair
-Do 100 sit-ups
-Lie on back and raise legs off the ground
YES
TRUNK STRENGTH 49
GO TO 807
NO
807
Does the task require the person to exert himself physically over a long period of time without getting winded?
e.g. -Mow a small yard
-Swim 100 yards
-Jog 3 miles
-Bicycle 20 miles
-Walk around the block
YES
STAMINA 50
END
NO
END

Appendix B

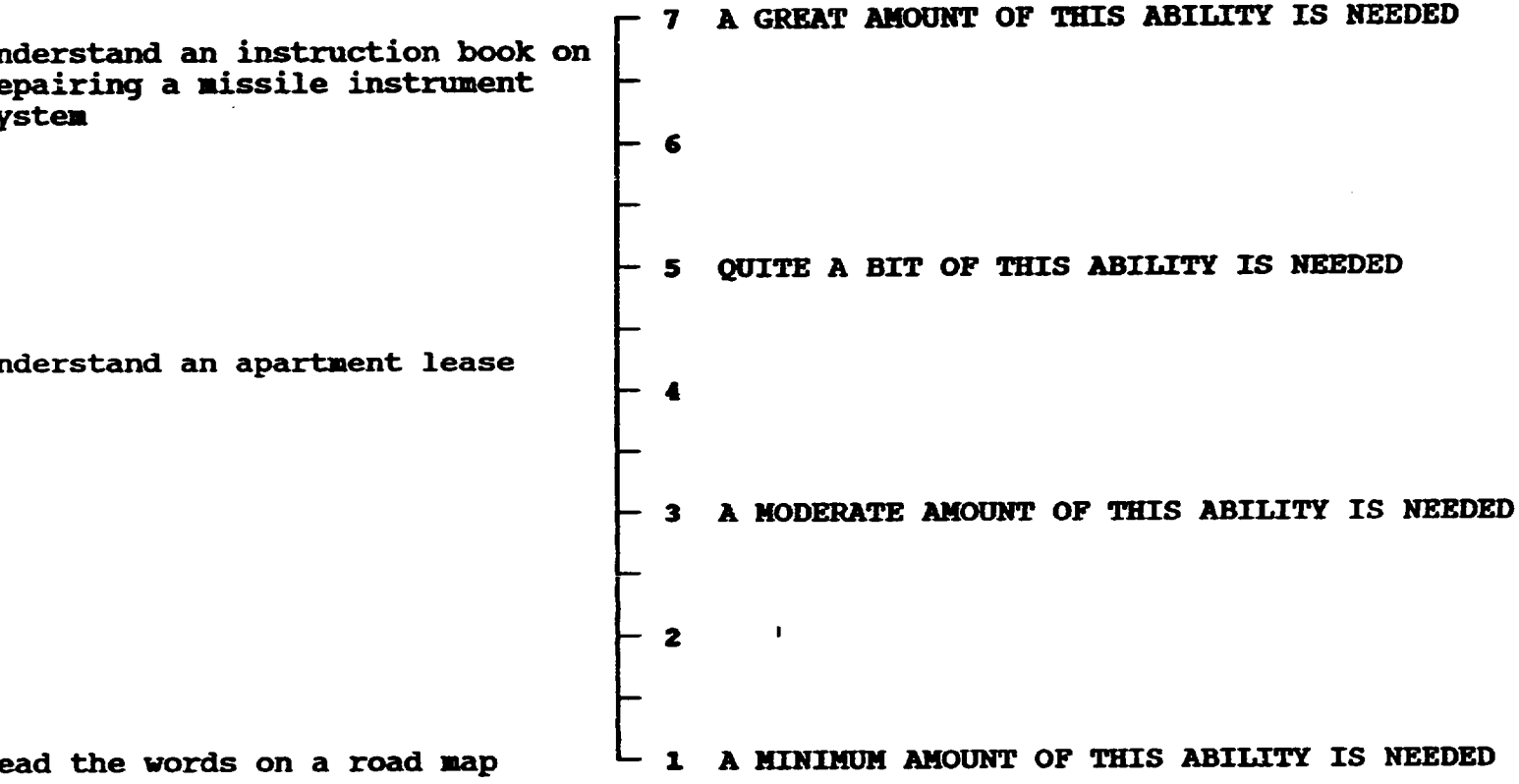
JCAT Part B Abilities Scalars

1. **ORAL COMPREHENSION:** The ability to listen to and understand words and sentences.



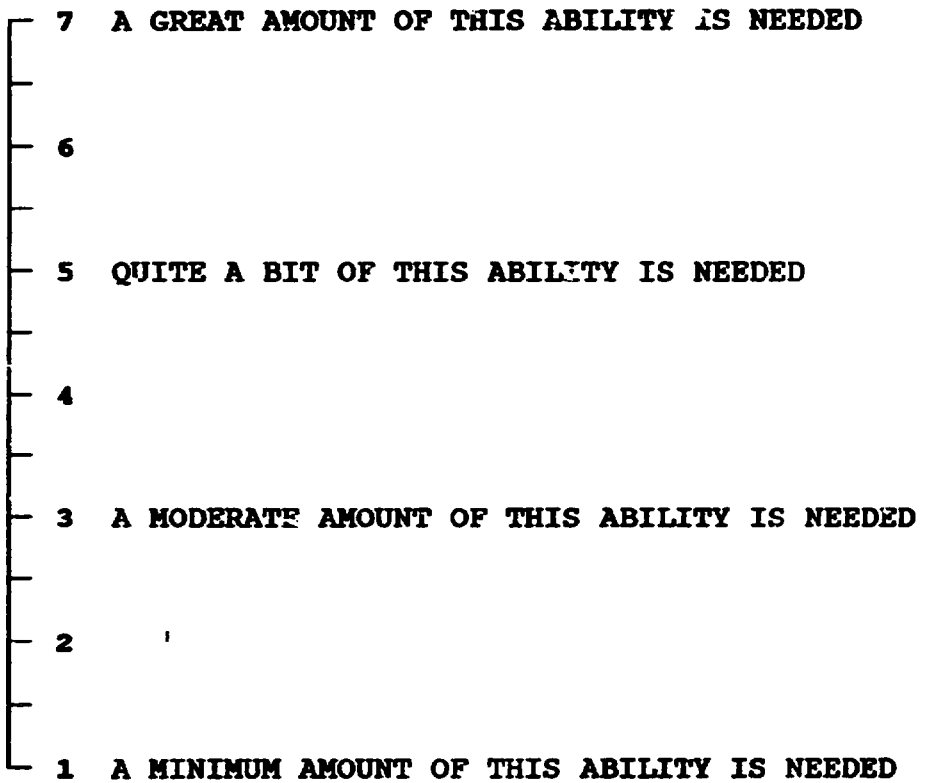
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

2. **WRITTEN COMPREHENSION:** The ability to understand written words, sentences, and paragraphs.



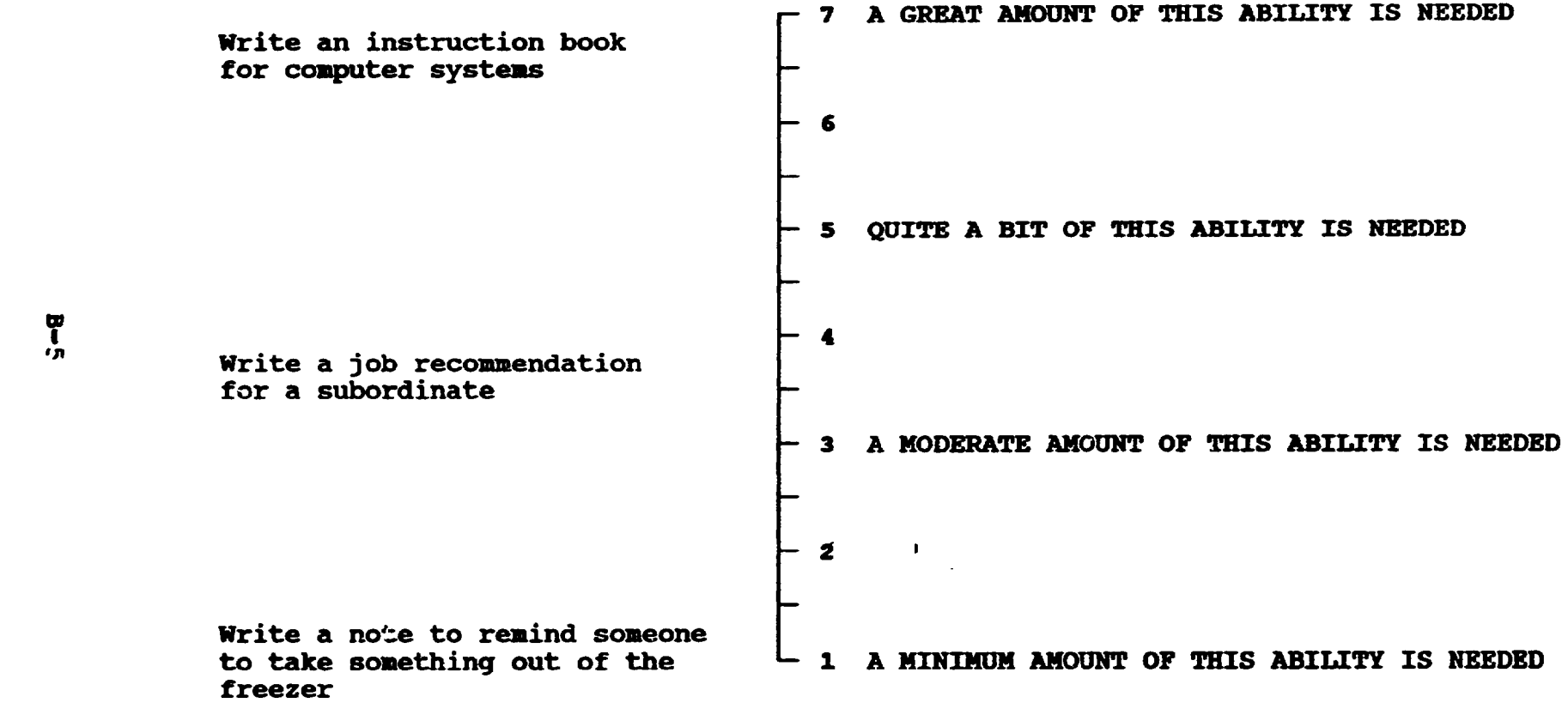
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

3. **ORAL EXPRESSION:** The ability to use words or sentences in speaking so that others will understand.



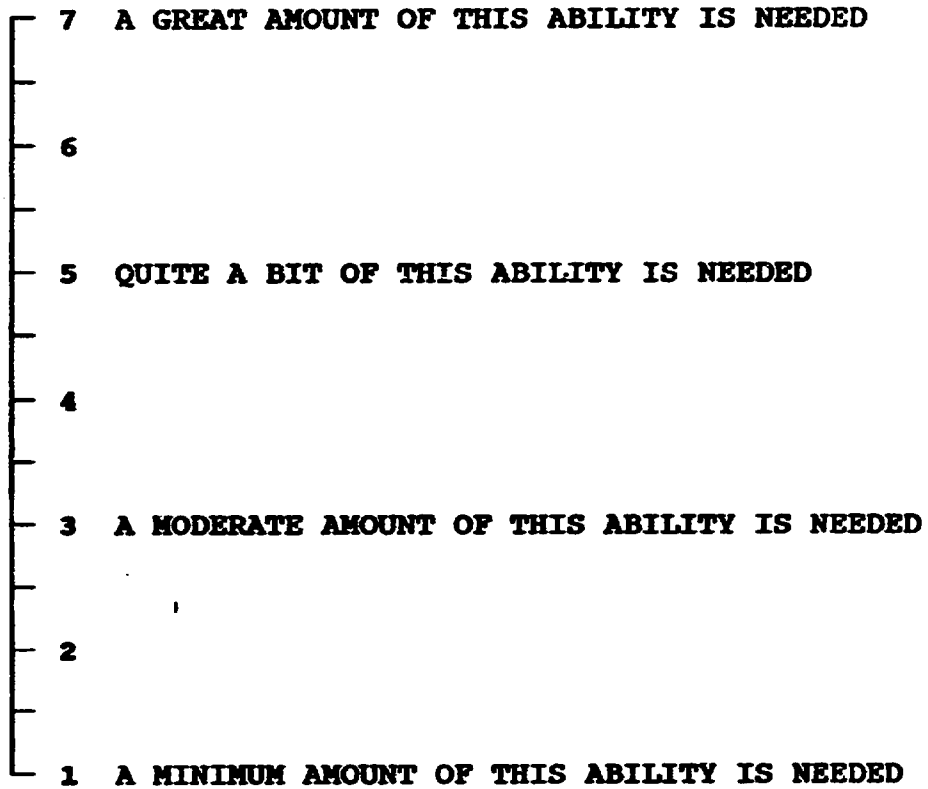
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

4. **WRITTEN EXPRESSION:** The ability to use words or sentences in writing so that others will understand.



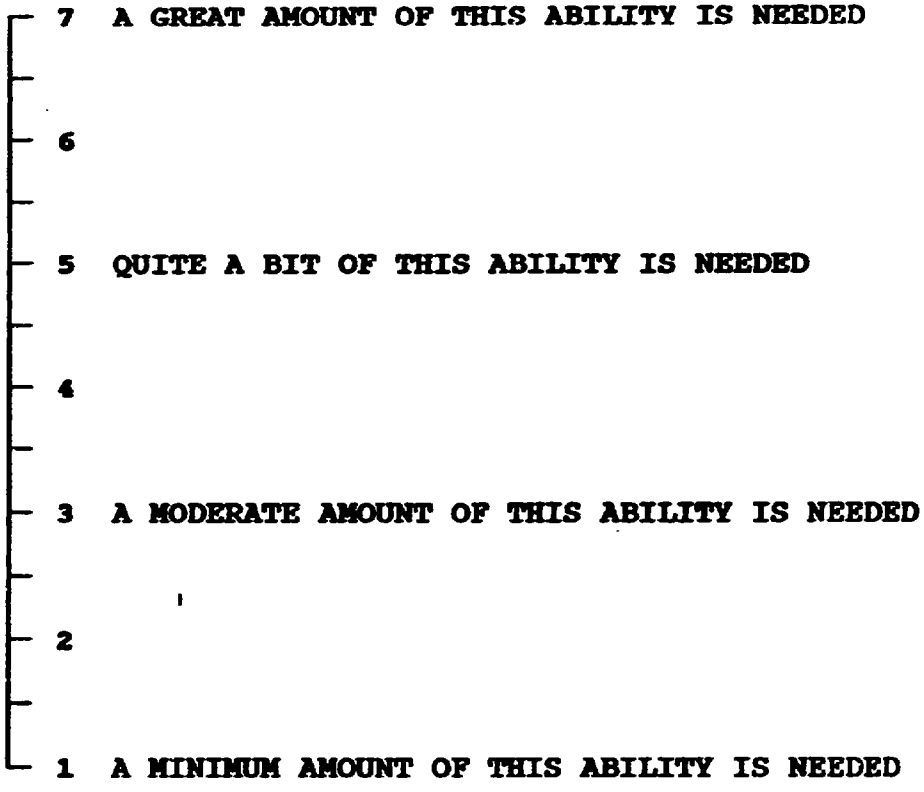
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

5. **MEMORIZATION:** The ability to memorize and remember information, such as words, numbers, pictures, and procedures. Pieces of information can be remembered by themselves or with other pieces of information.



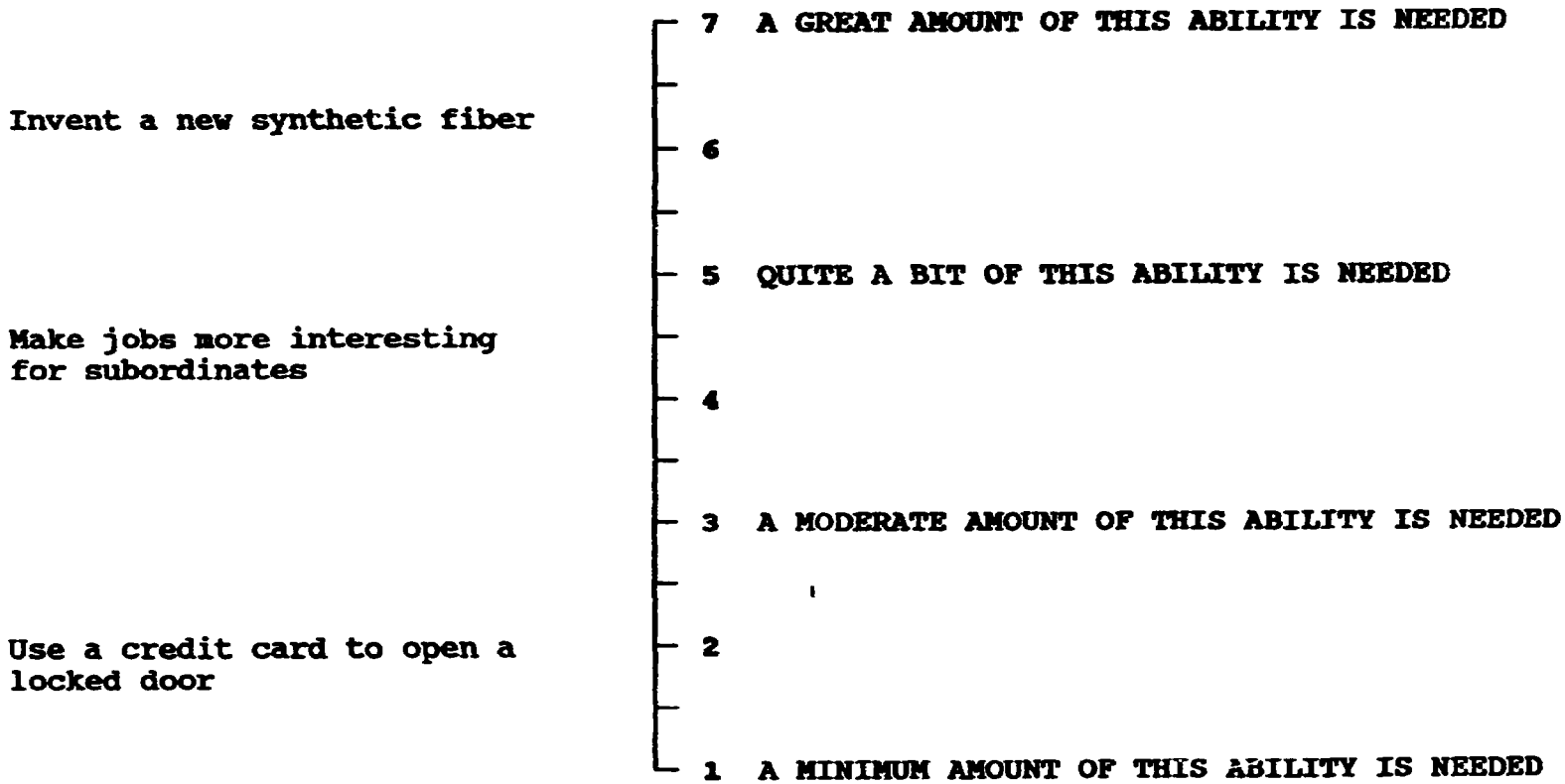
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

6. **PROBLEM SENSITIVITY:** The ability to tell when something is wrong or is likely to go wrong. It includes being able to identify the whole problem as well as the elements of the problem.



HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

7. **ORIGINALITY:** The ability to produce unusual or clever ideas about a given topic or situation. It is the ability to invent creative solutions to problems or develop new procedures for situations in which standard procedures do not apply or are not working.



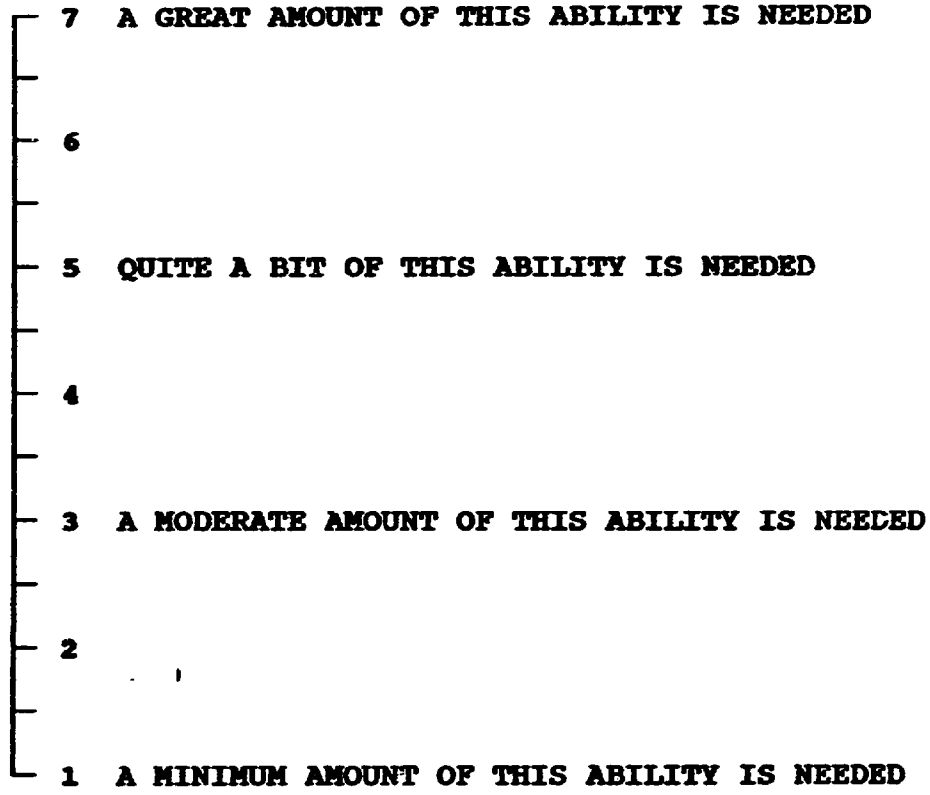
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

8. **FLUENCY OF IDEAS:** The ability to produce a number of ideas about a given topic.

Name all possible problems that might occur with a space launch

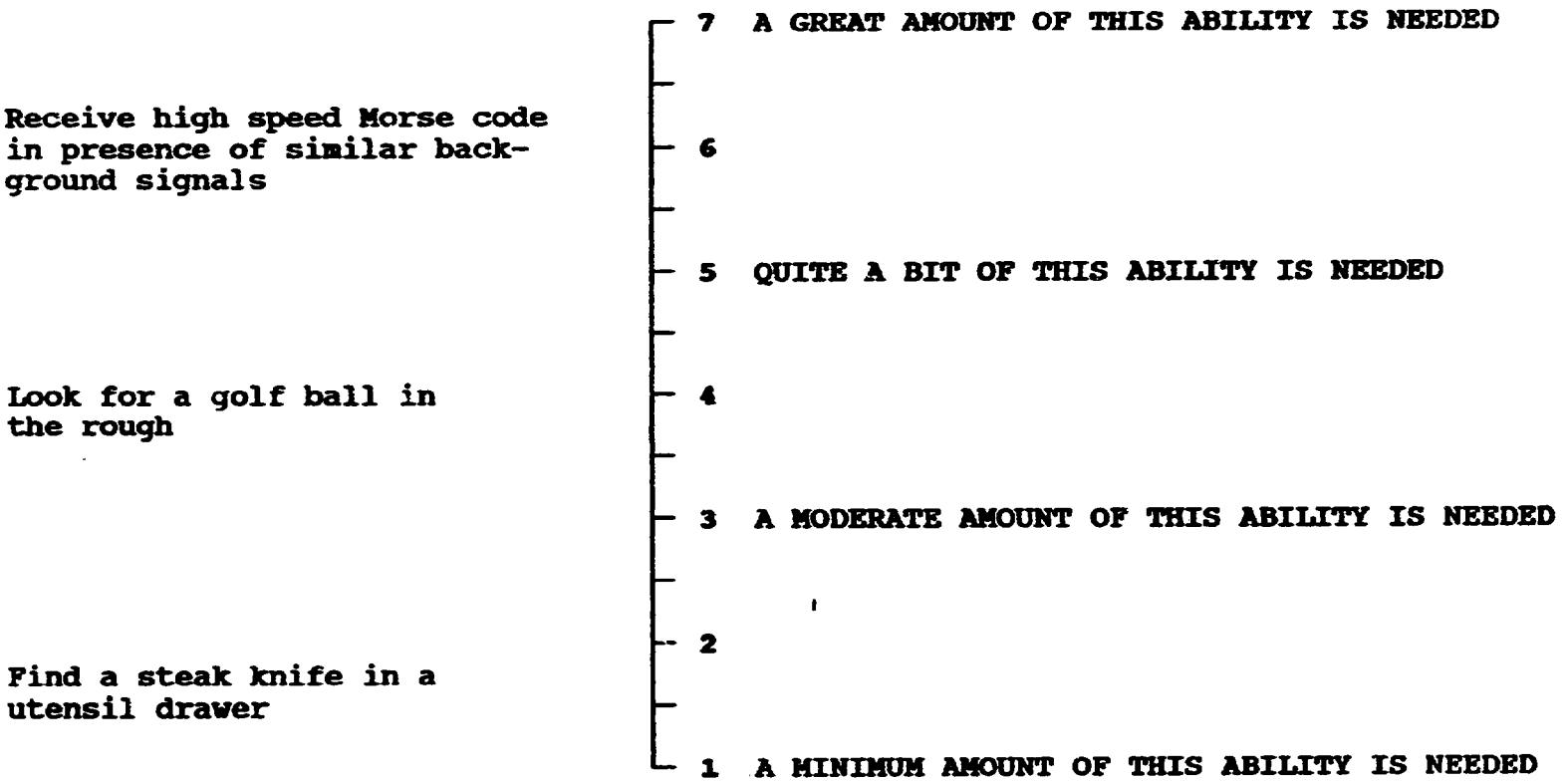
Think of as many ideas as possible for the name of a new organization

Name four brands of toothpaste



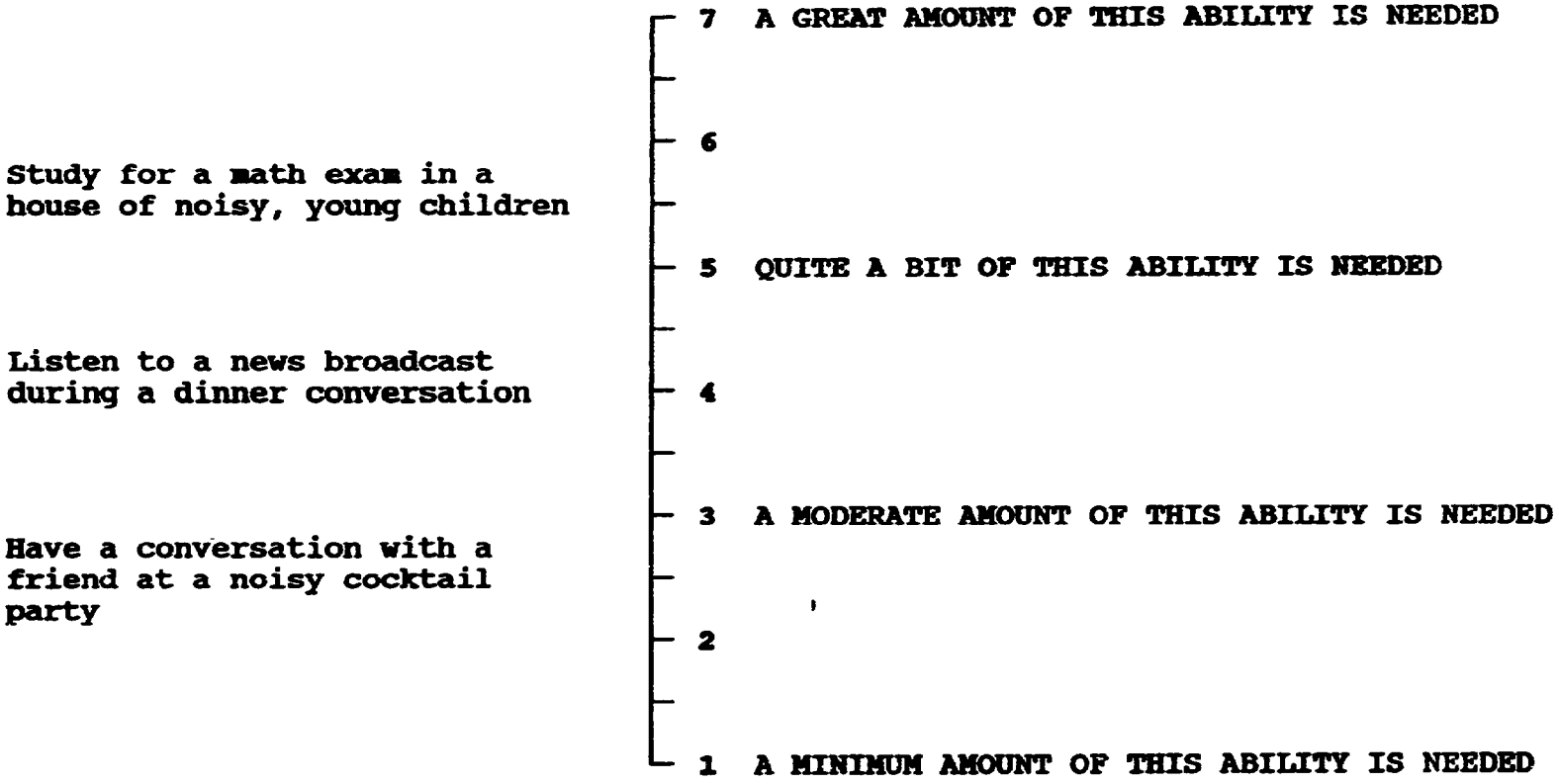
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

9. **FLEXIBILITY OF CLOSURE:** The ability to identify or detect a known pattern (like a figure, word, or object) that is hidden in other material. The task is to pick out the disguised pattern from the background material. (Pattern Recognition)



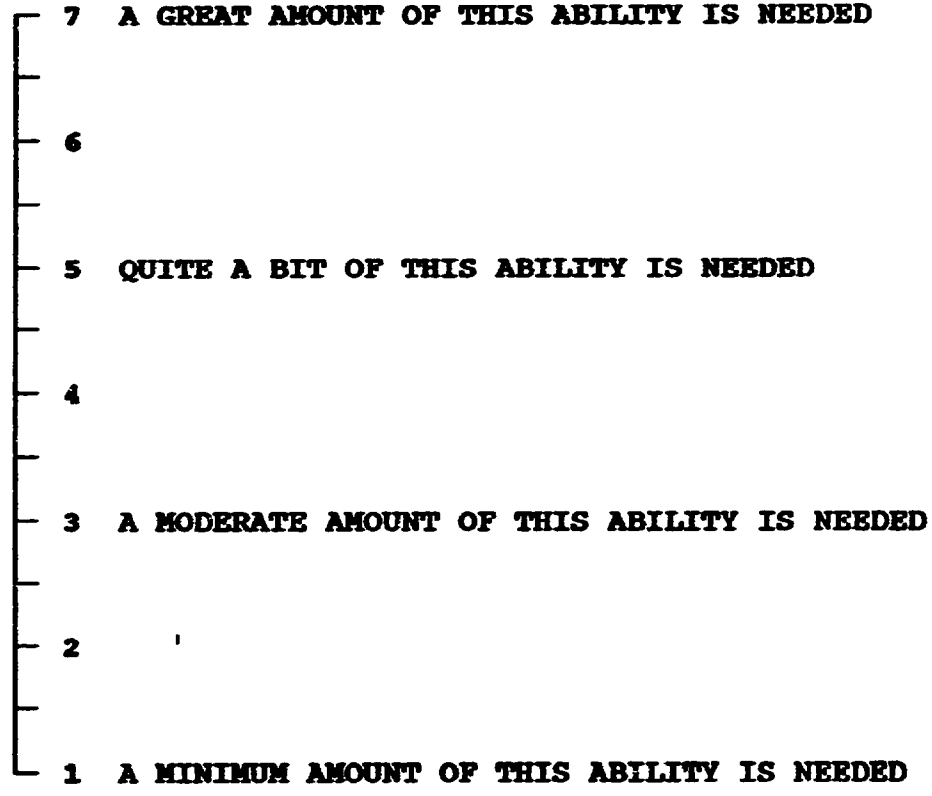
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

10. **SELECTIVE ATTENTION:** The ability to concentrate on a task one is doing. This ability includes concentrating while performing a boring task and not being distracted.



HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

11. **SPATIAL ORIENTATION:** The ability to tell where you are in relation to the location of some object or to tell where the object is in relation to you.



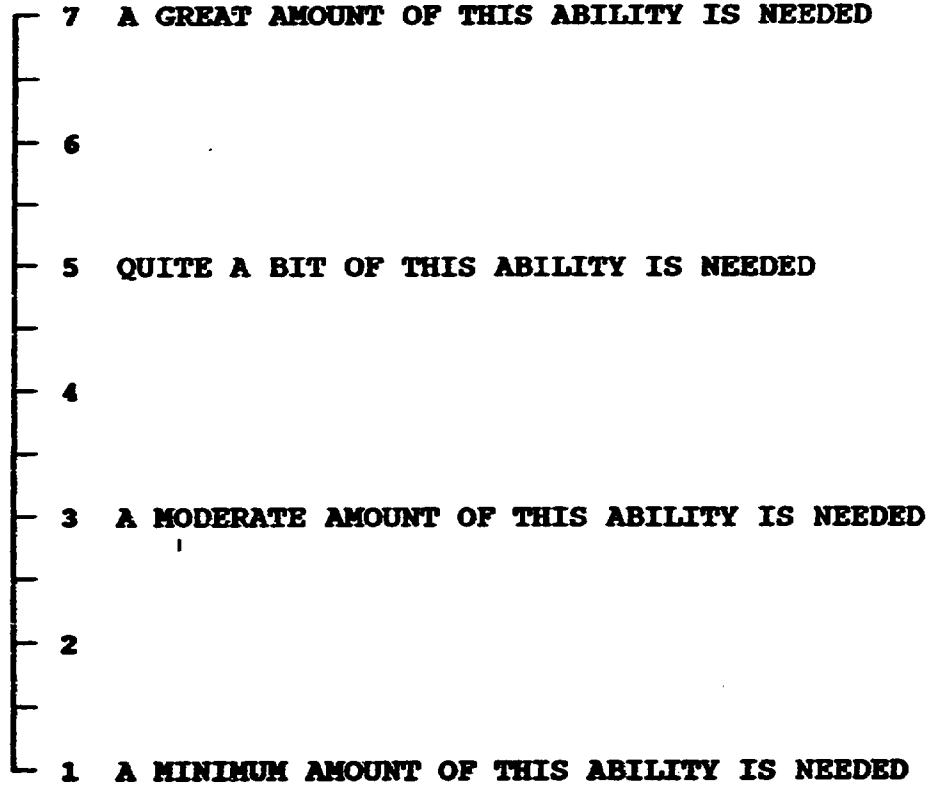
Be aware of your orientation upon awakening in a gravity-free environment, like a space-craft

While lost in a rural area, locate your position on a road map

Find your way through a familiar room when lights are out without bumping into anything

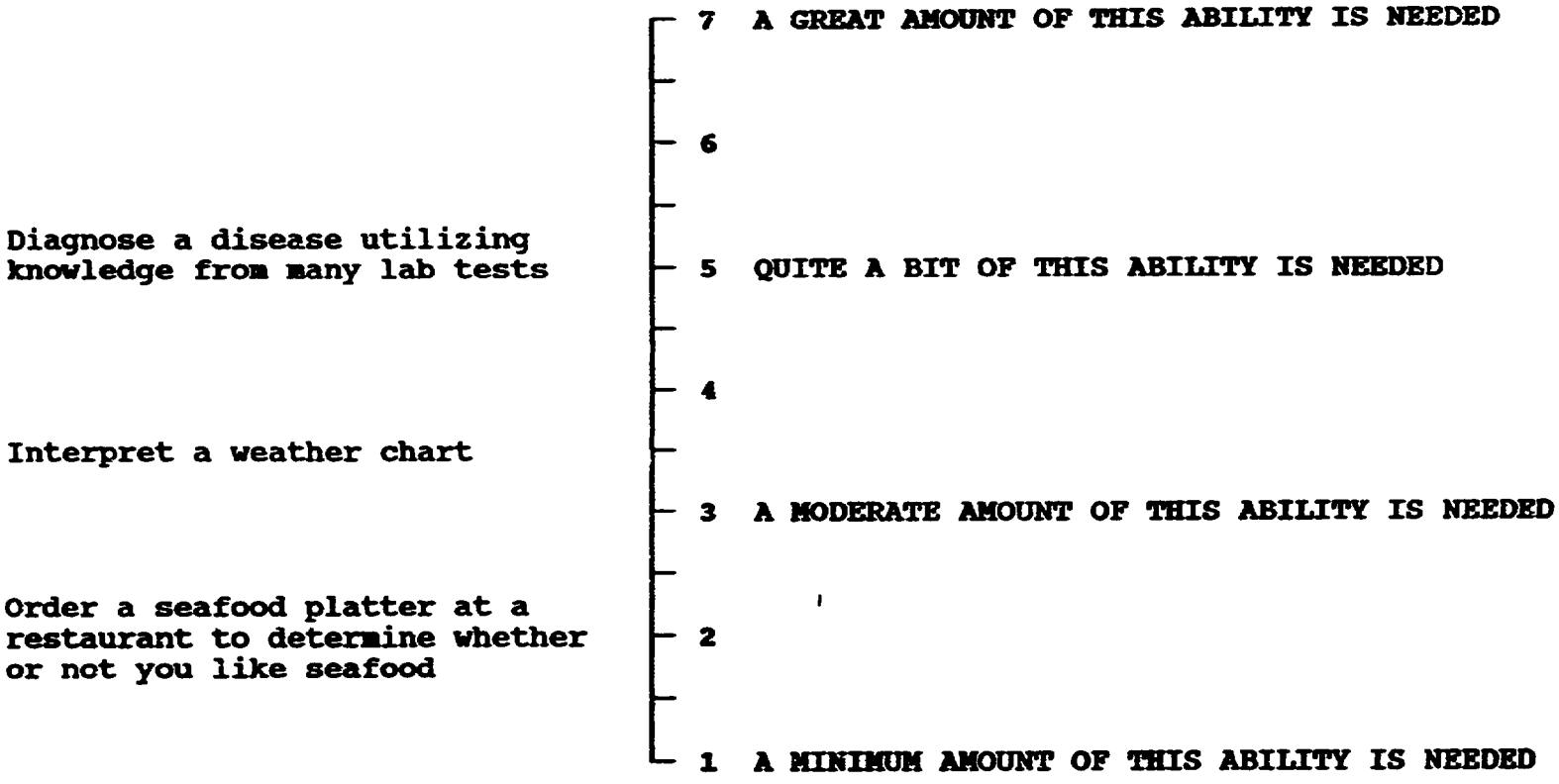
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

12. **VISUALIZATION:** The ability to imagine how something will look when it is moved around or when its parts are moved or rearranged. It requires the forming of mental images of how patterns or objects would look after certain changes, such as unfolding or rotation. One has to predict how an object, set of objects, or pattern will appear after the changes are carried out.



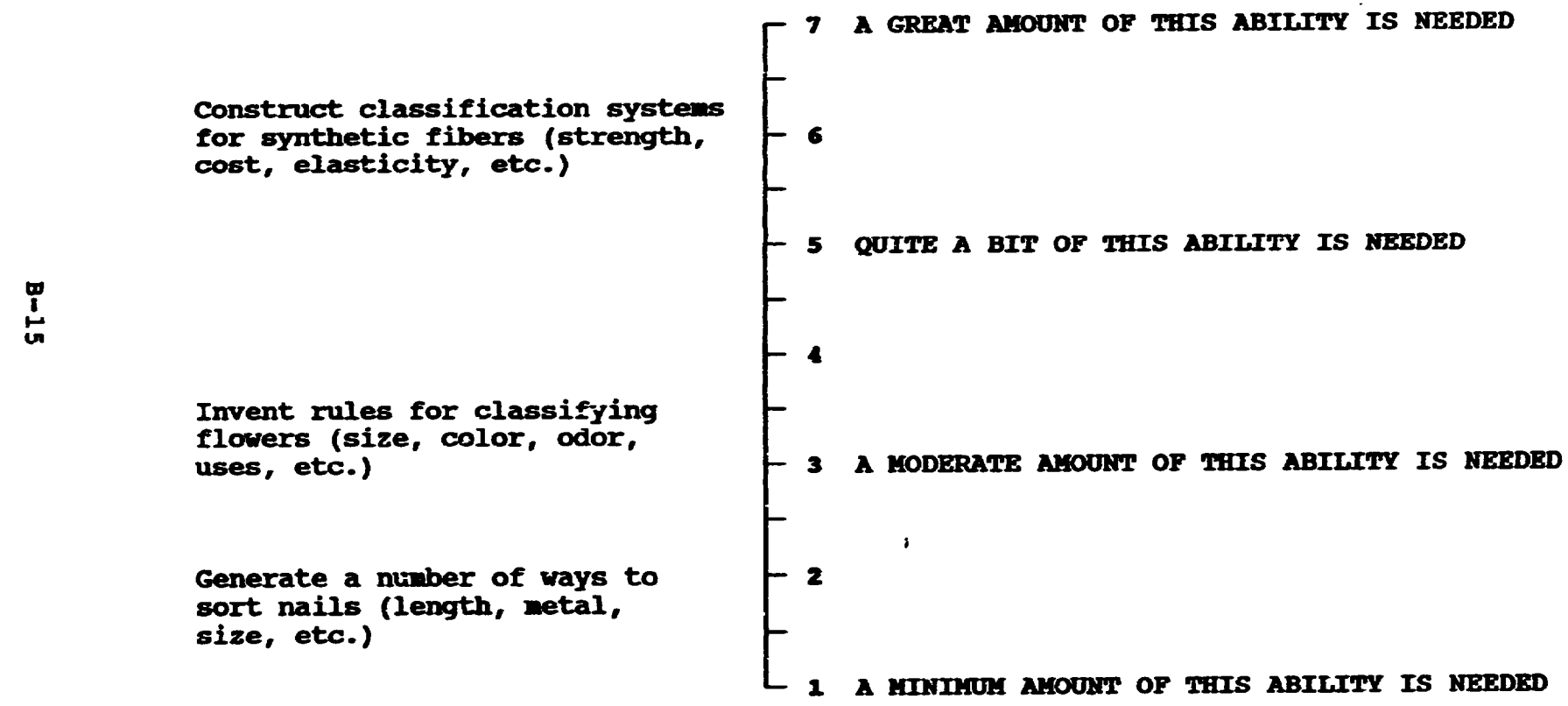
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

13. **INDUCTIVE REASONING:** The ability to combine separate pieces of information, or specific answers to problems, to form general rules or conclusions. It involves the ability to think of possible reasons for why things go together.



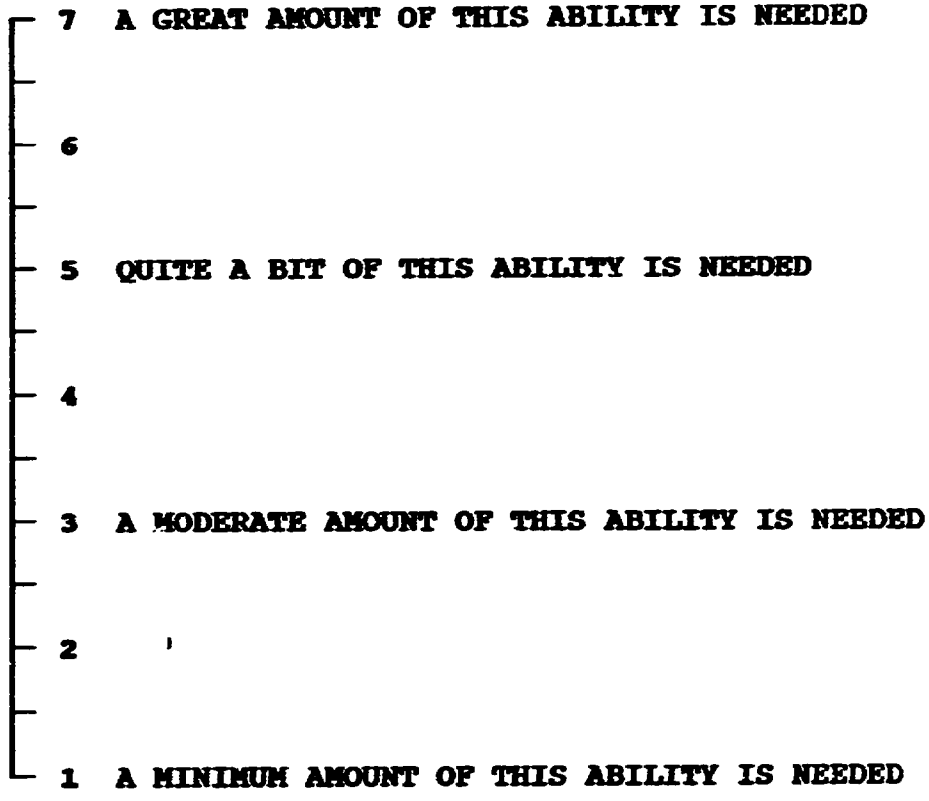
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

14. **CATEGORY FLEXIBILITY:** The ability to produce many rules so that each rule tells how to group a set of things in a different way. Each different group must contain at least two things from the original set of things.



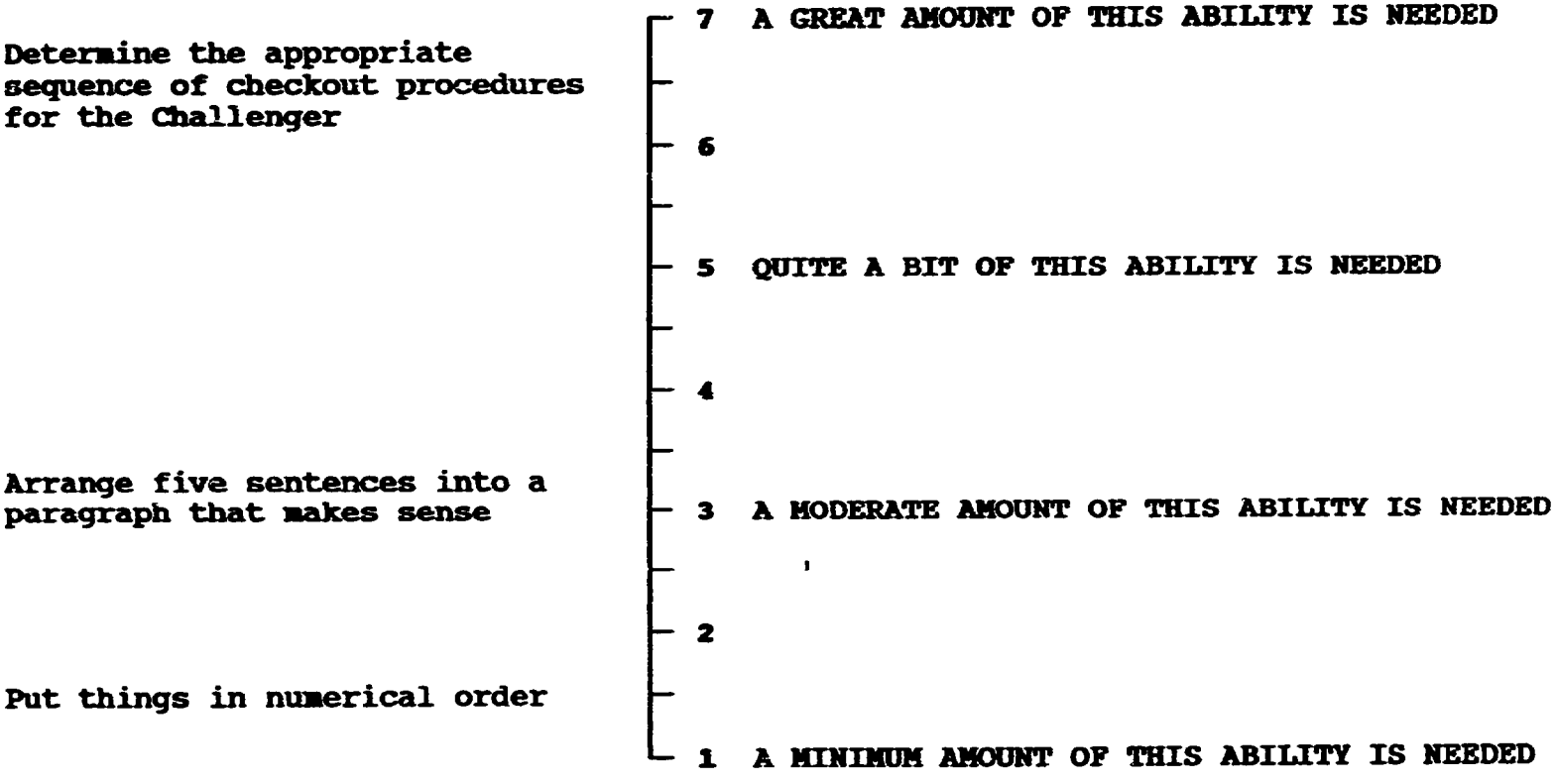
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

15. **DEDUCTIVE REASONING:** The ability to apply general rules to specific problems to come up with logical answers. It involves deciding if an answer makes sense.



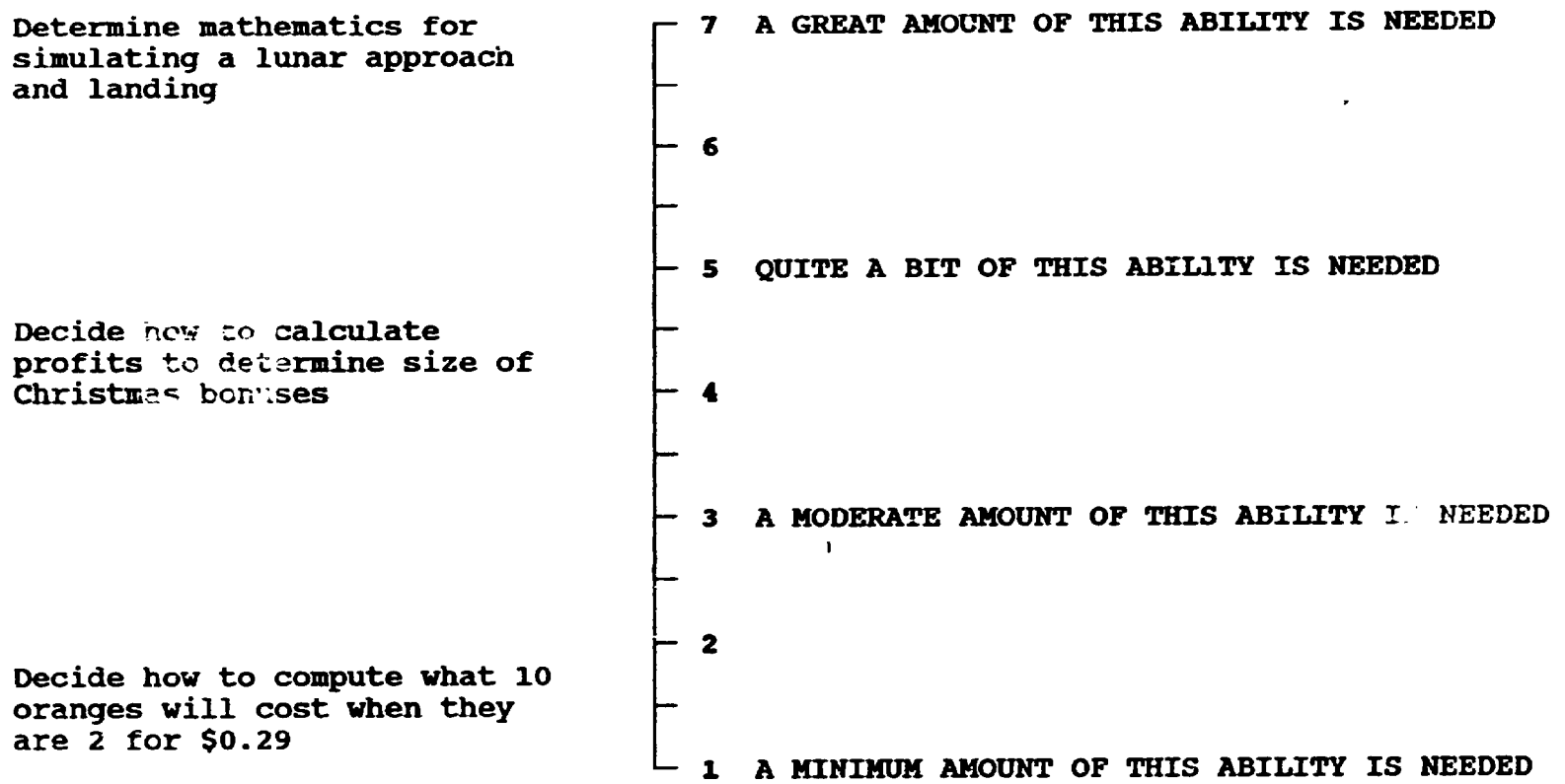
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

16. **INFORMATION ORDERING:** The ability to follow correctly a rule or set of rules to arrange things or actions in a certain order. The rule or set of rules used must be given. The things or actions to be put in order can include numbers, letters, words, pictures, procedures, sentences, and mathematical or logical operations.



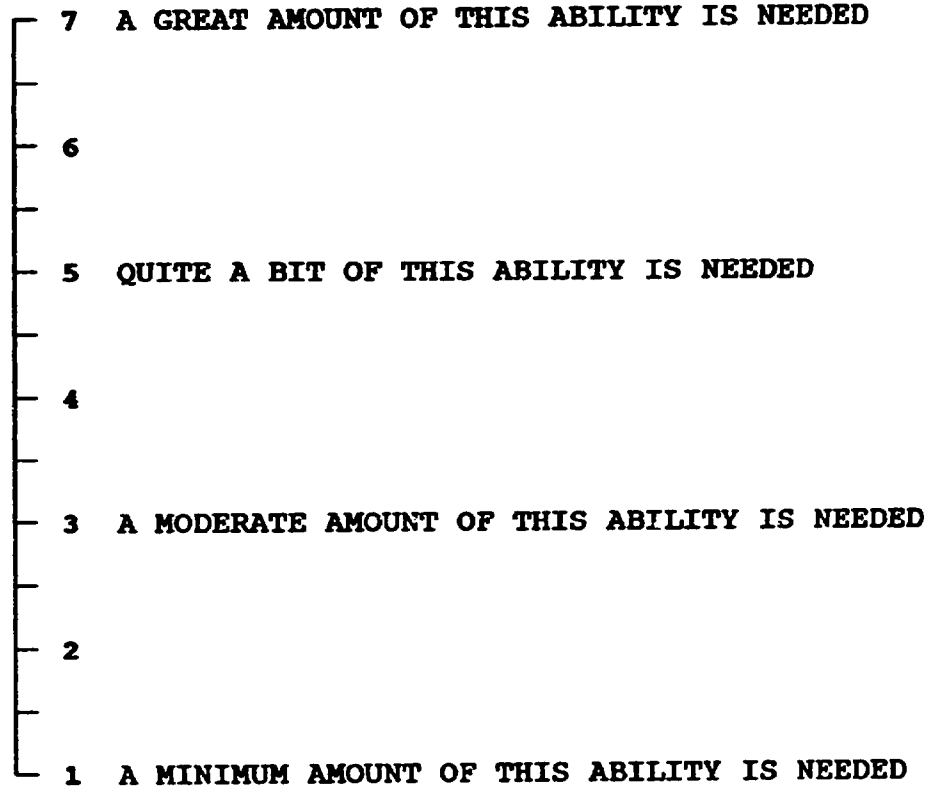
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

17. **MATHEMATICAL REASONING:** The ability to understand and organize a problem and then select a mathematical method or formula to solve the problem. It encompasses reasoning through mathematical problems to determine appropriate operations that can be performed to solve problems. It also includes the understanding or structuring of mathematical problems. The actual manipulation of numbers is not included in this ability.



HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

18. **NUMBER FACILITY:** Involves the degree to which adding, subtracting, multiplying, and dividing can be done quickly and correctly. These can be steps in other operations like finding percentages and taking square roots.



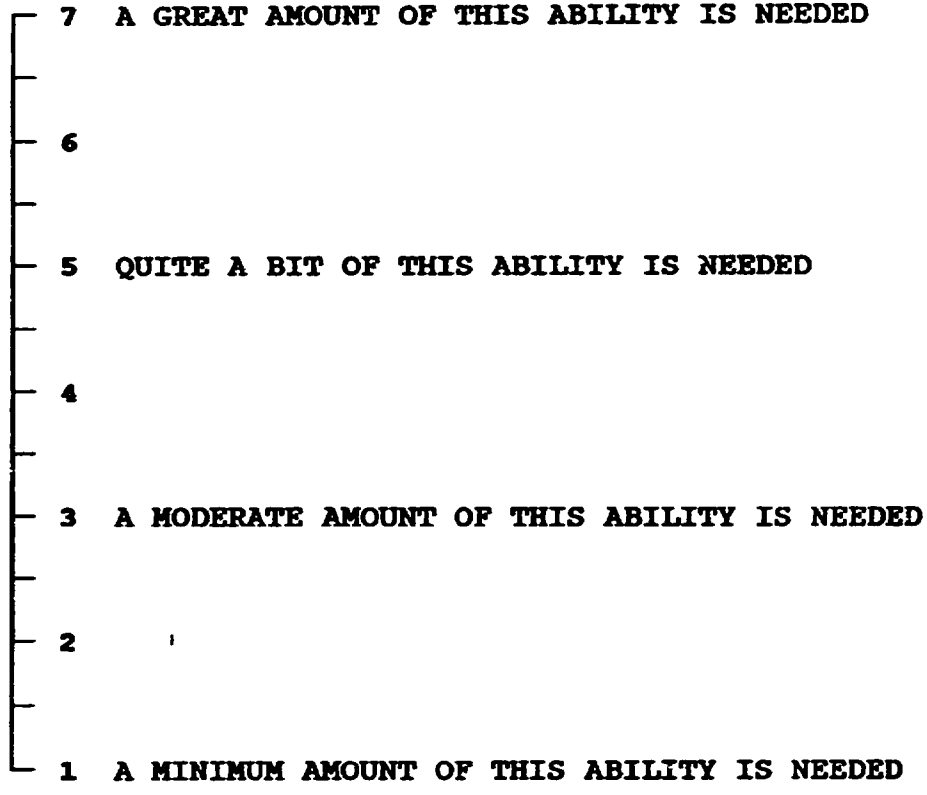
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

19. **TIME SHARING:** The ability to shift back and forth between two or more sources of information.

Keep track of all inbound and outbound planes during a period of heavy traffic

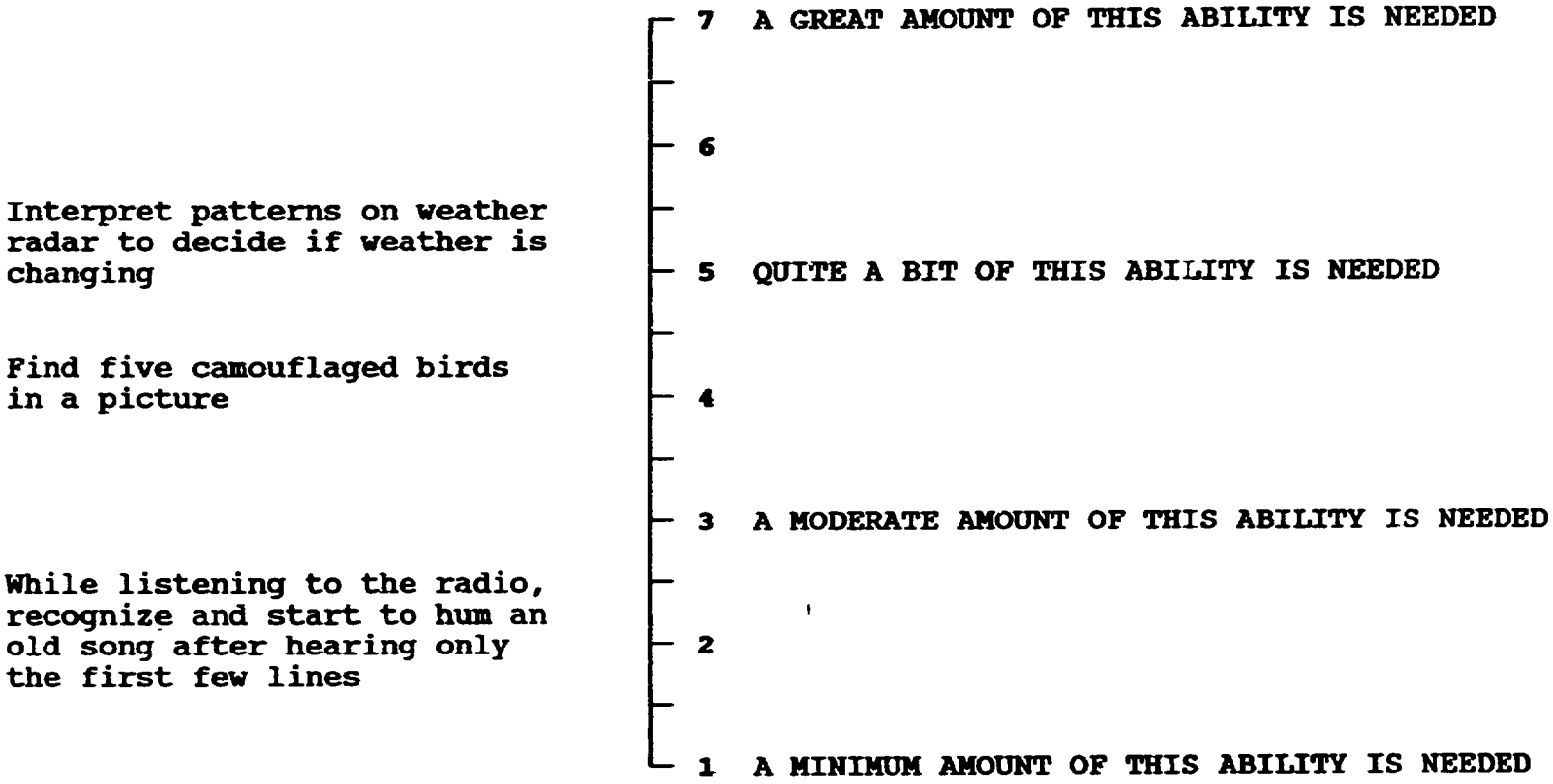
Monitor several TV channels at the same time

Watch street signs and the road while driving 30 mph



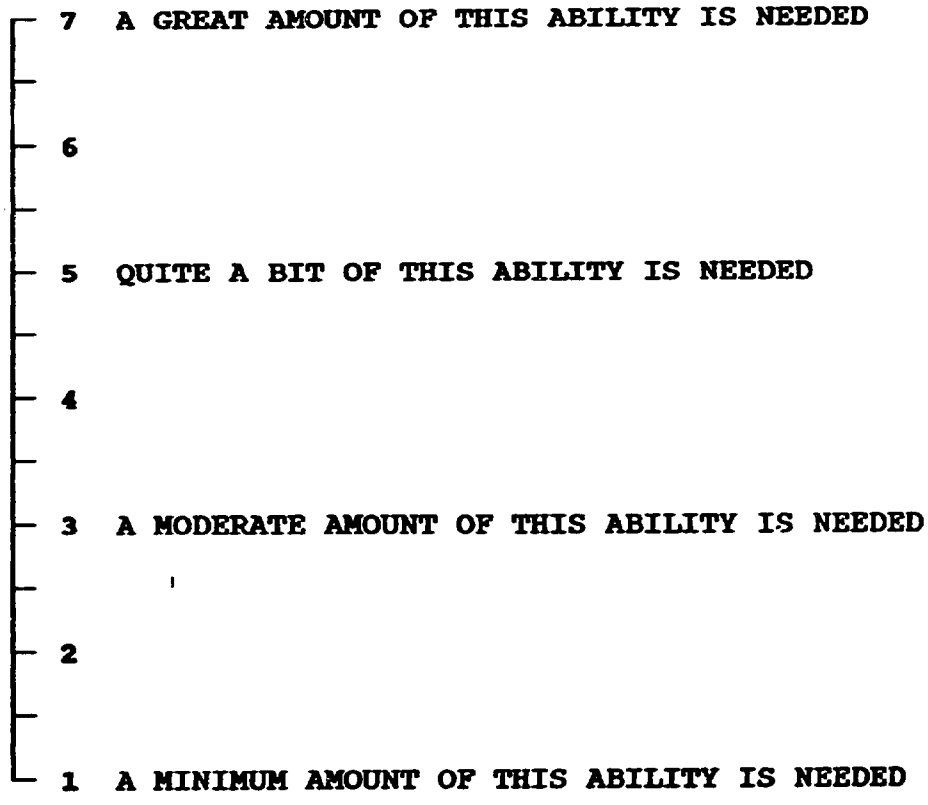
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

20. **SPEED OF CLOSURE:** Involves the degree to which different pieces of information can be combined and organized into one meaningful pattern quickly. It is not known beforehand what the pattern will be. The material may be visual or auditory.



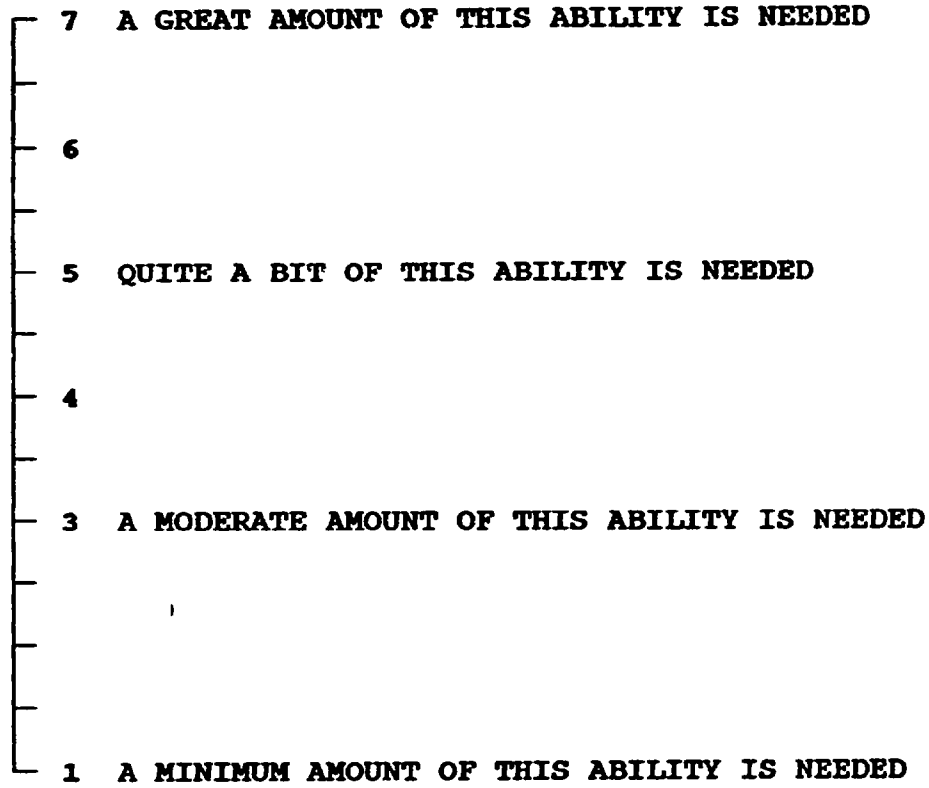
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

21. **PERCEPTUAL SPEED AND ACCURACY:** Involves the degree to which one can compare letters, numbers, objects, pictures, or patterns, quickly and accurately. The things to be compared may be presented at the same time or one after the other. This ability also includes comparing a presented object with a remembered object.



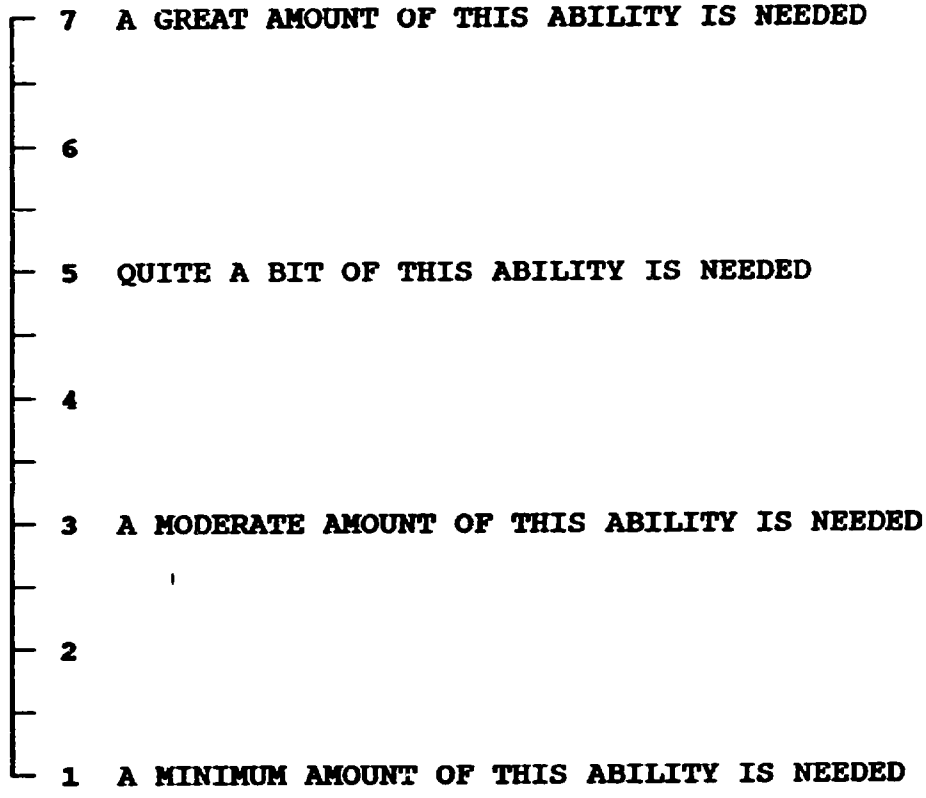
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

22. **REACTION TIME:** The ability to give one fast response to one signal (sound, light, picture) when it appears. This ability is concerned with the speed with which the movement can be started with the hand, foot, or other parts of the body.



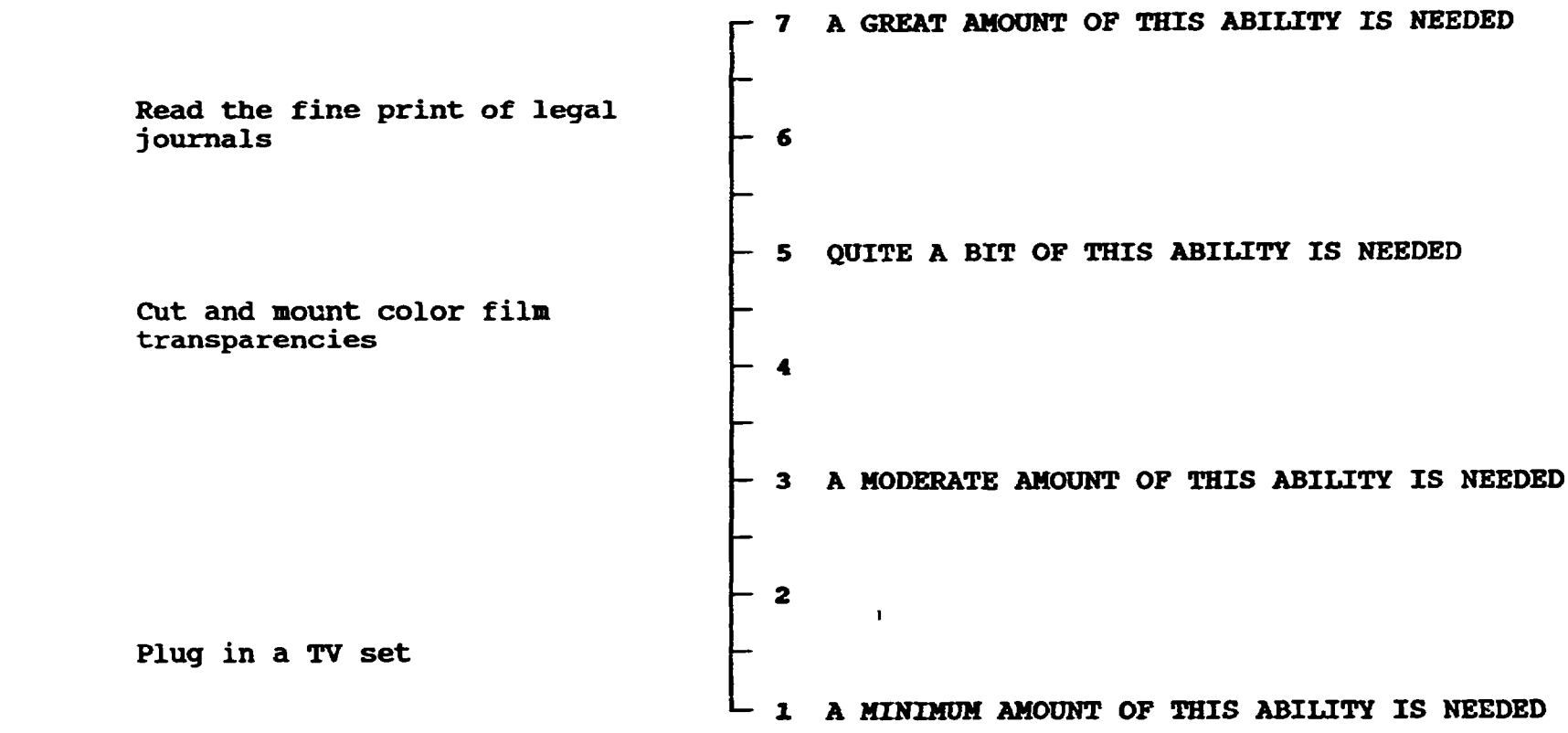
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

23. **CHOICE REACTION TIME:** The ability to choose between two or more movements quickly and accurately when two or more different signals (lights, sounds, pictures) are given. The ability is concerned with the speed with which the right response can be started with the hand, foot, or other parts of the body.



HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

24. **NEAR VISION:** The capacity to see close environmental surroundings.



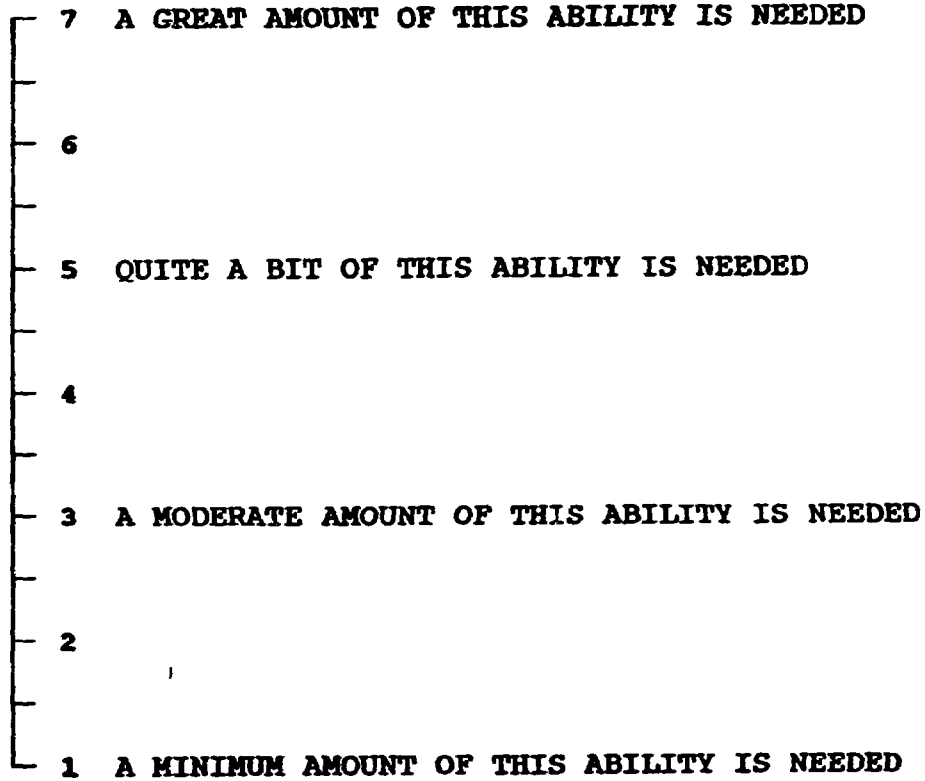
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

25. **FAR VISION:** The capacity to see distant environmental surroundings.

Detect differences in ocean vehicles on the horizon

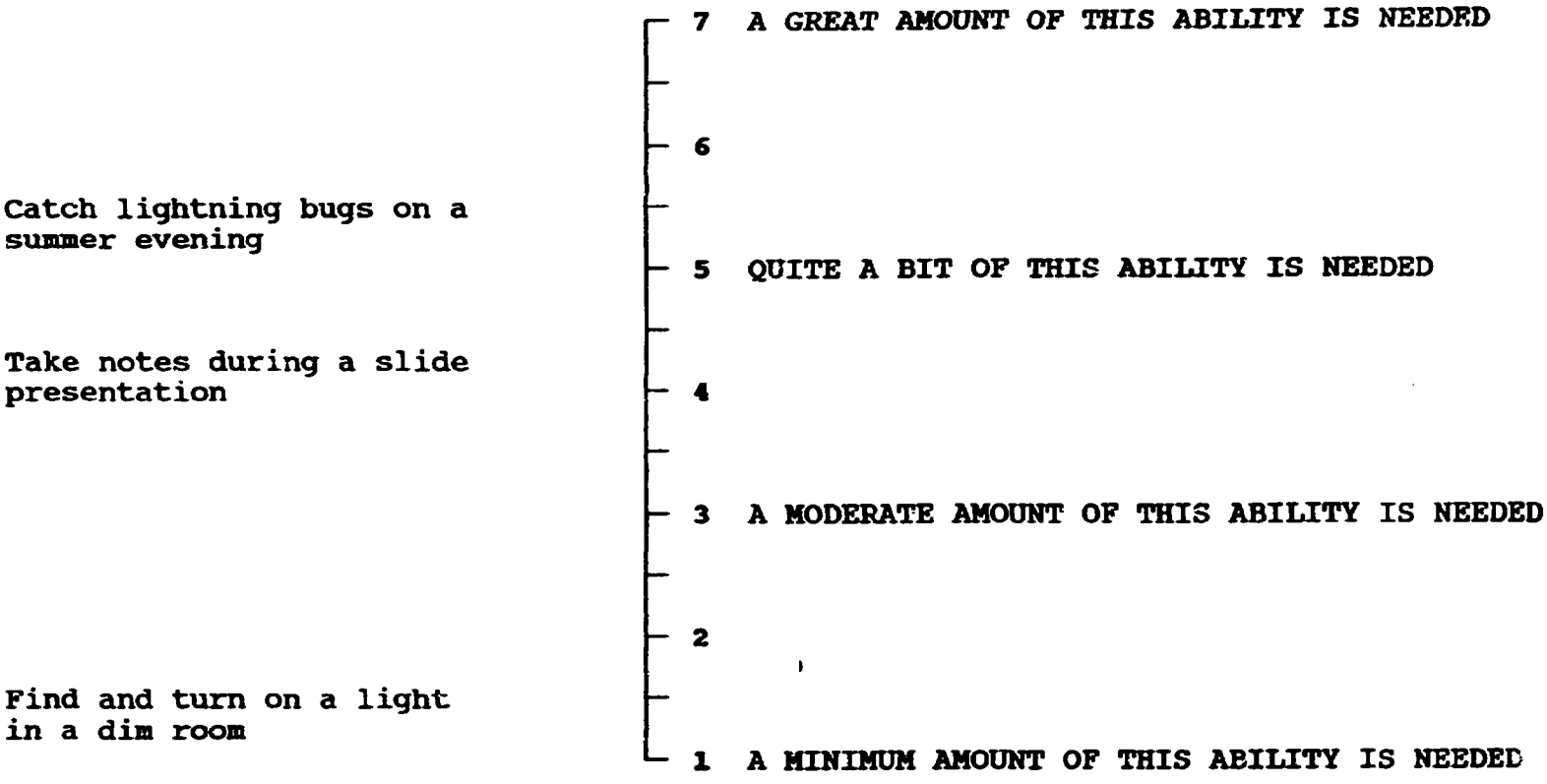
Drive a moving van across country

Point out a mountain range in the distance



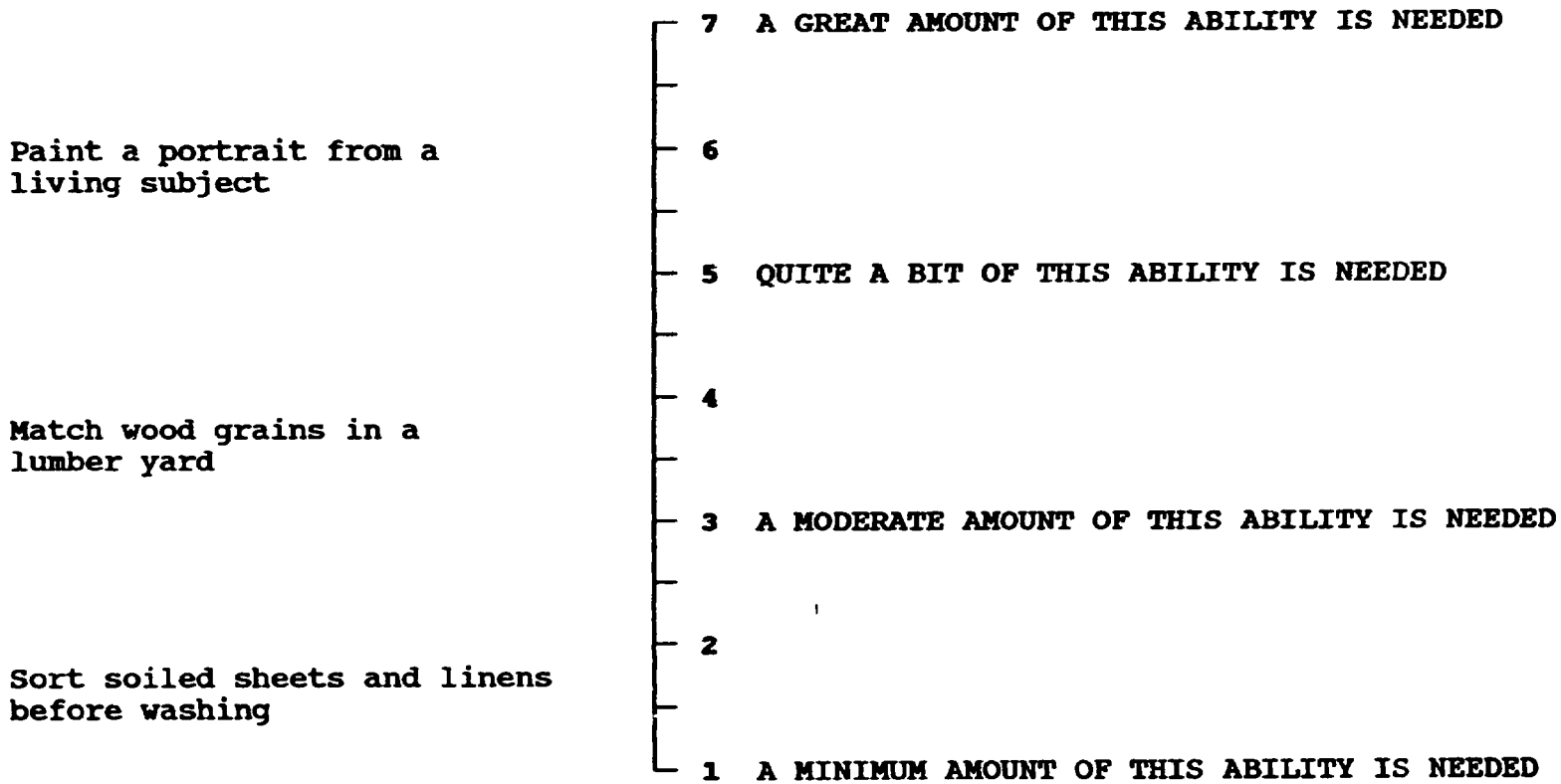
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

26. **NIGHT VISION:** The ability to see under low light conditions.



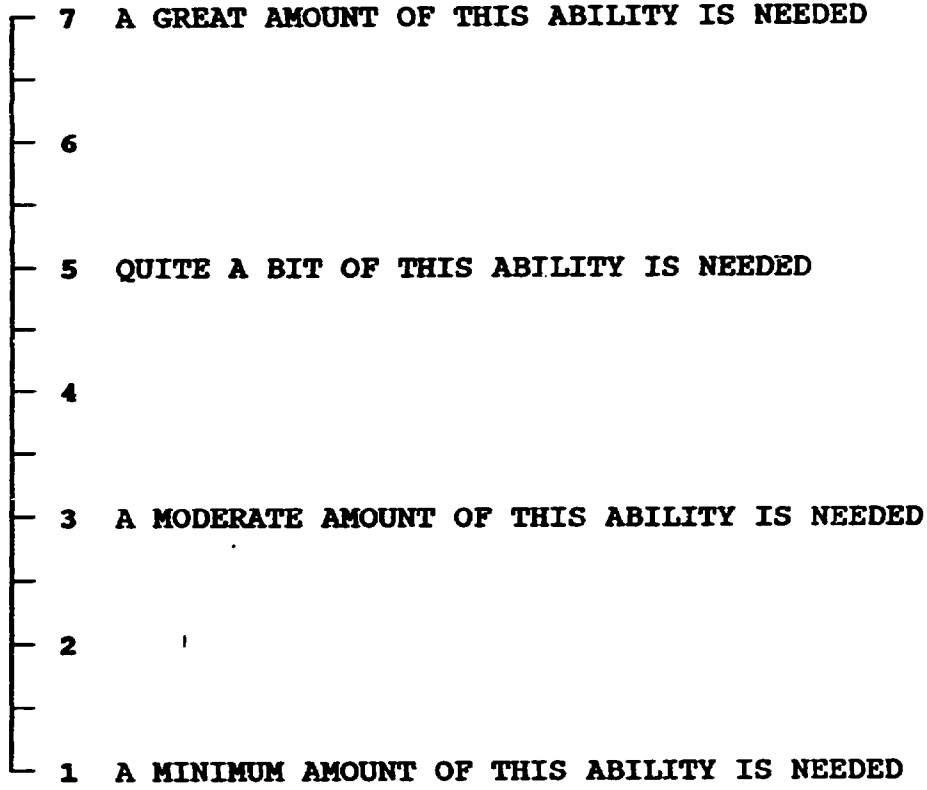
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

27. **VISUAL COLOR DISCRIMINATION:** The capacity to match or discriminate between colors. This capacity also includes detecting differences in color purity (saturations) and brightness (brilliance).



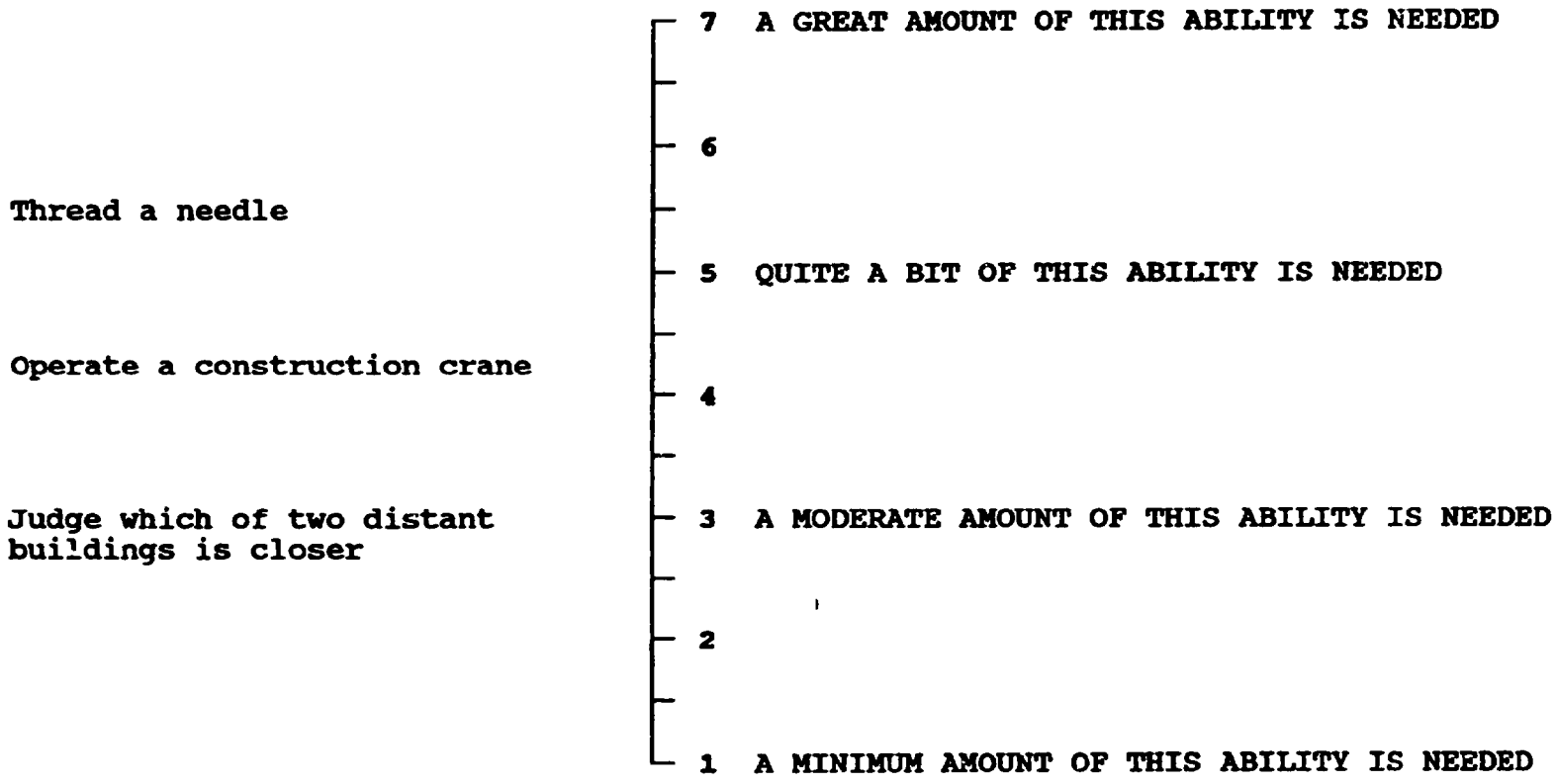
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

28. **PERIPHERAL VISION:** The ability to perceive objects or movements towards the edges of the visual field.



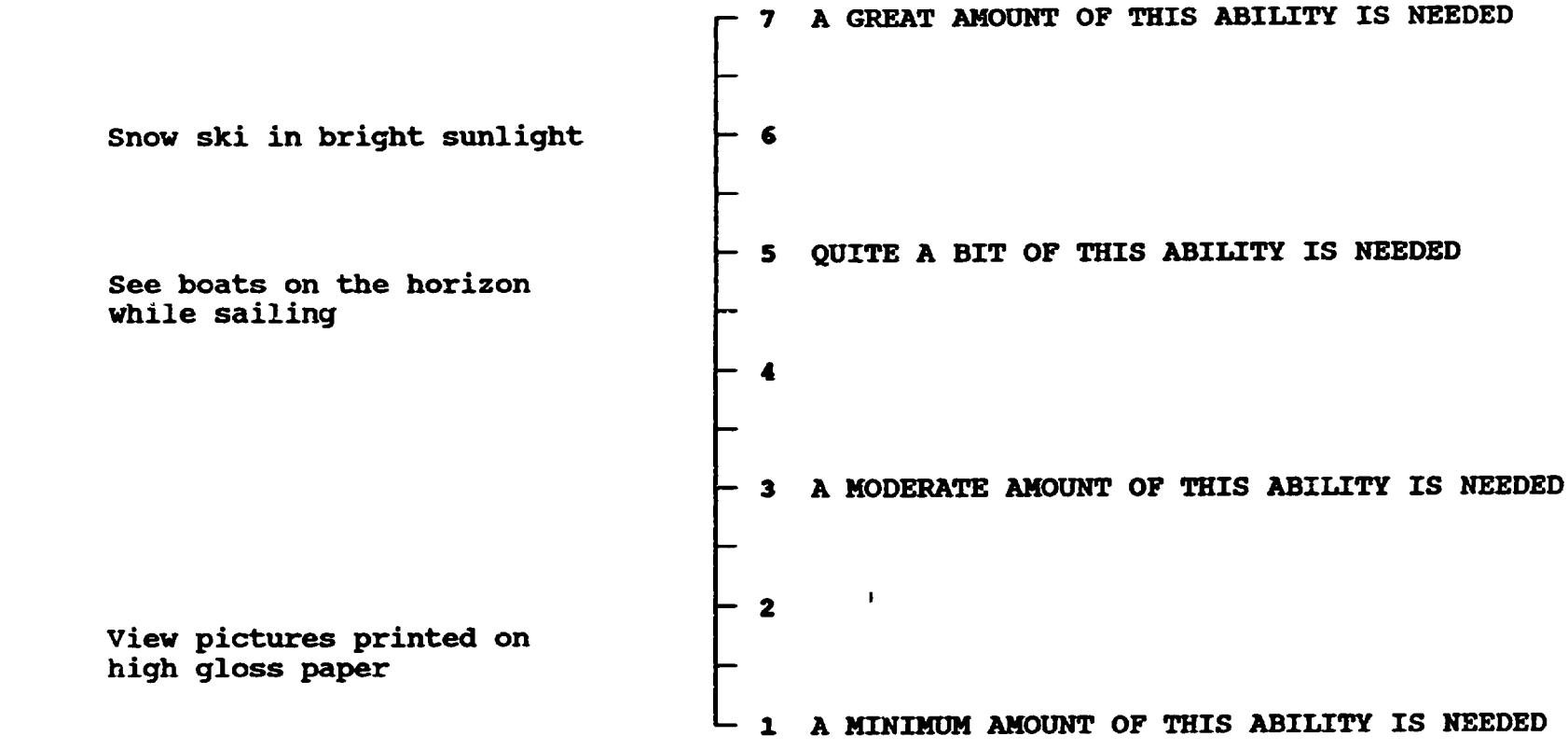
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

29. **DEPTH PERCEPTION:** The ability to distinguish which of several objects is more distant from or nearer to the observer, or to judge the distance of an object from the observer.



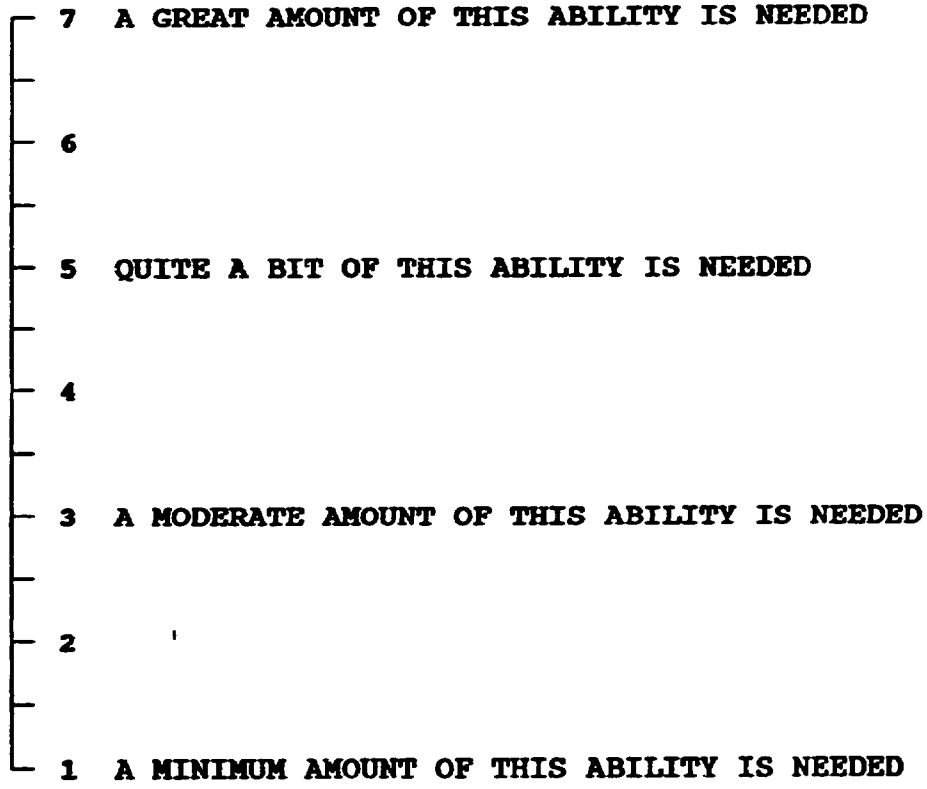
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

30. **GLARE SENSITIVITY:** The ability to see objects in the presence of glare or bright ambient lighting.



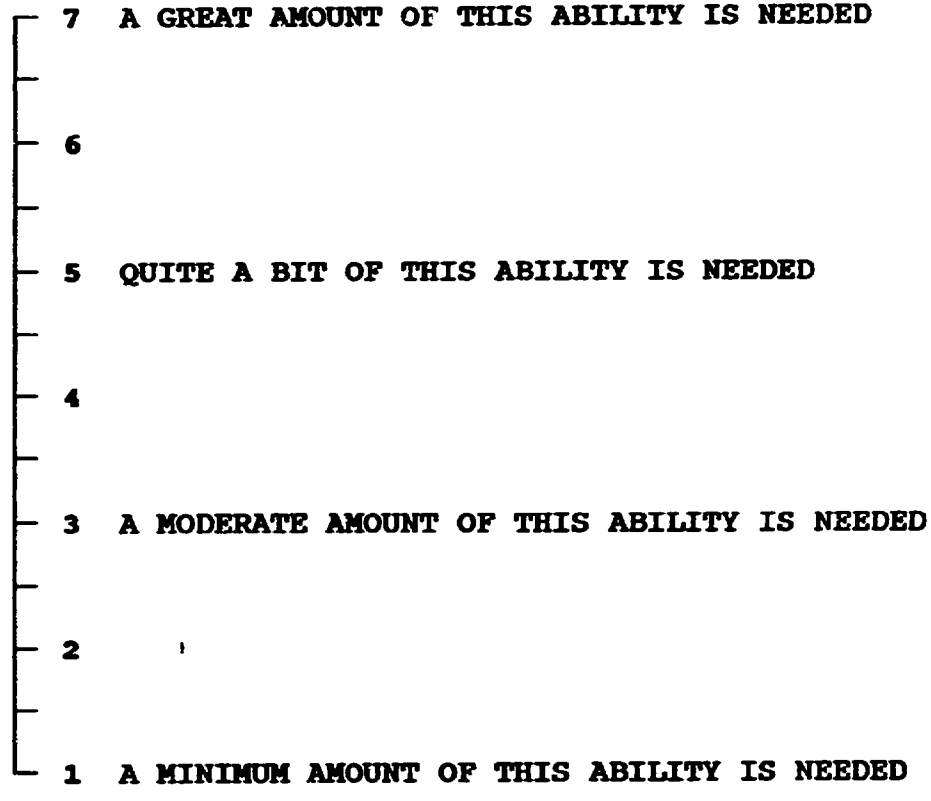
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

31. **GENERAL HEARING:** The ability to detect and to discriminate among sounds that vary over broad ranges of pitch and/or loudness.



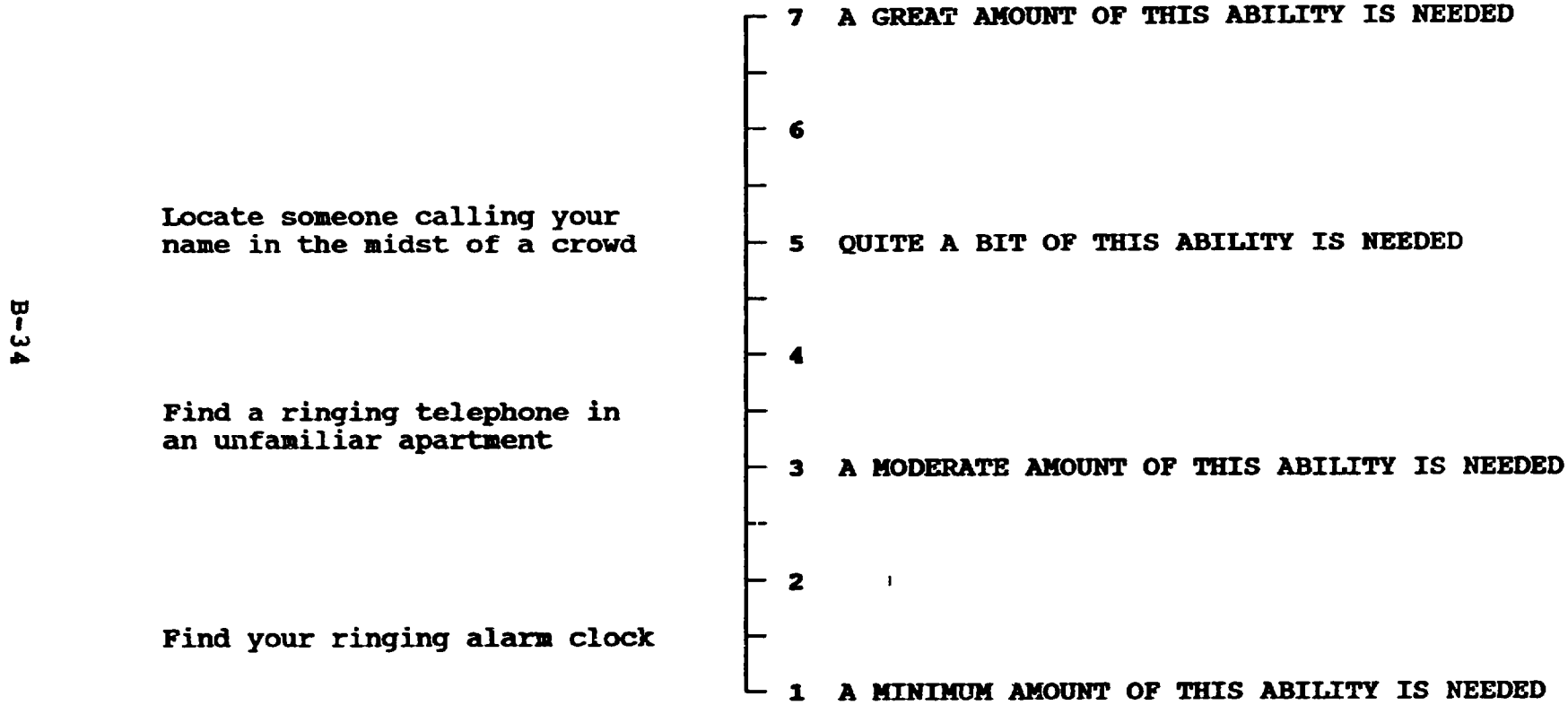
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

32. **AUDITORY ATTENTION:** The ability to focus on a single source of auditory information in the presence of other distracting and irrelevant auditory stimuli.



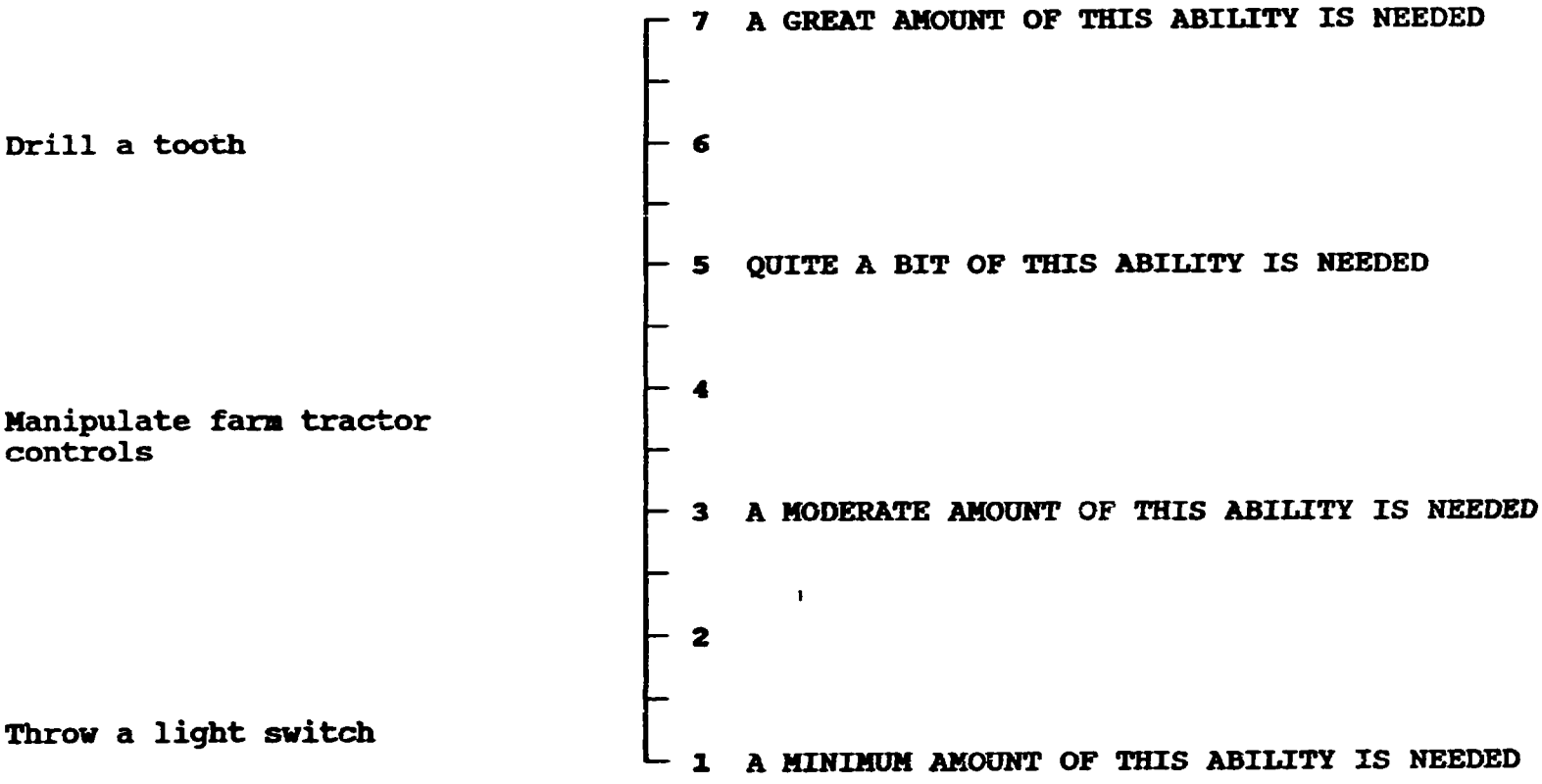
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

33. **SOUND LOCALIZATION:** The ability to identify the direction from which an auditory stimulus originated relative to the observer.



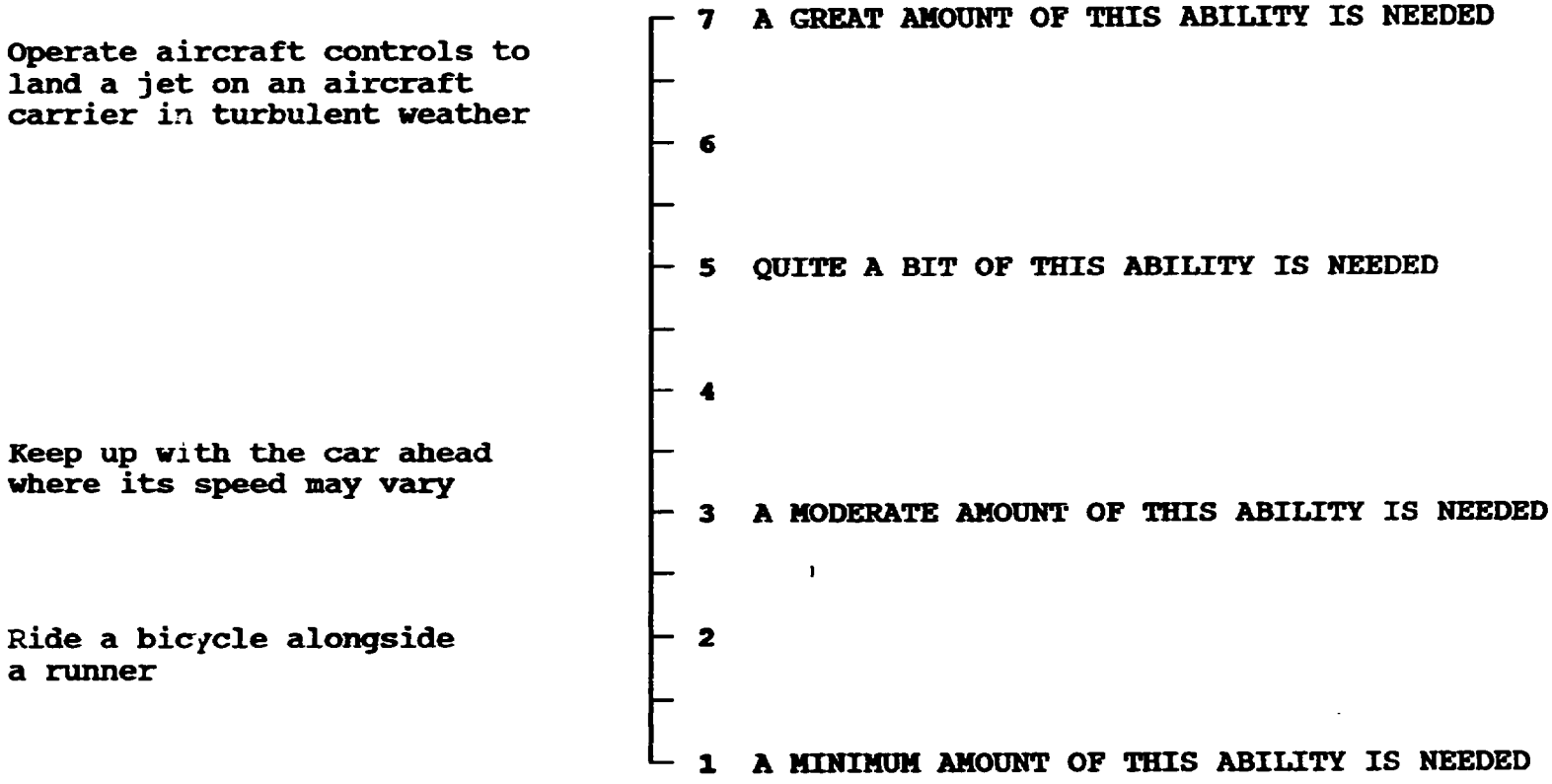
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

34. **CONTROL PRECISION:** The ability to move controls of a machine or vehicle. This involves the degree to which these controls can be moved quickly and repeatedly to exact positions.



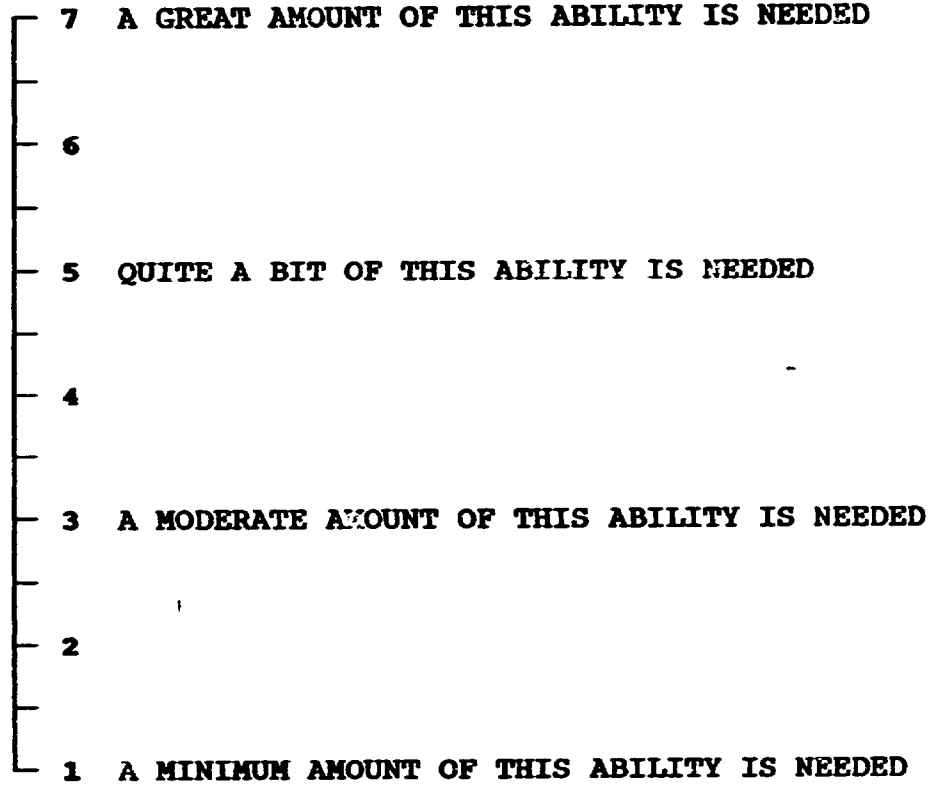
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

35. **RATE CONTROL:** The ability to adjust an equipment control in response to changes in the speed and/or direction of a continuously moving object or scene. The ability does not extend to situations in which the speed and direction of the object are perfectly predictable.



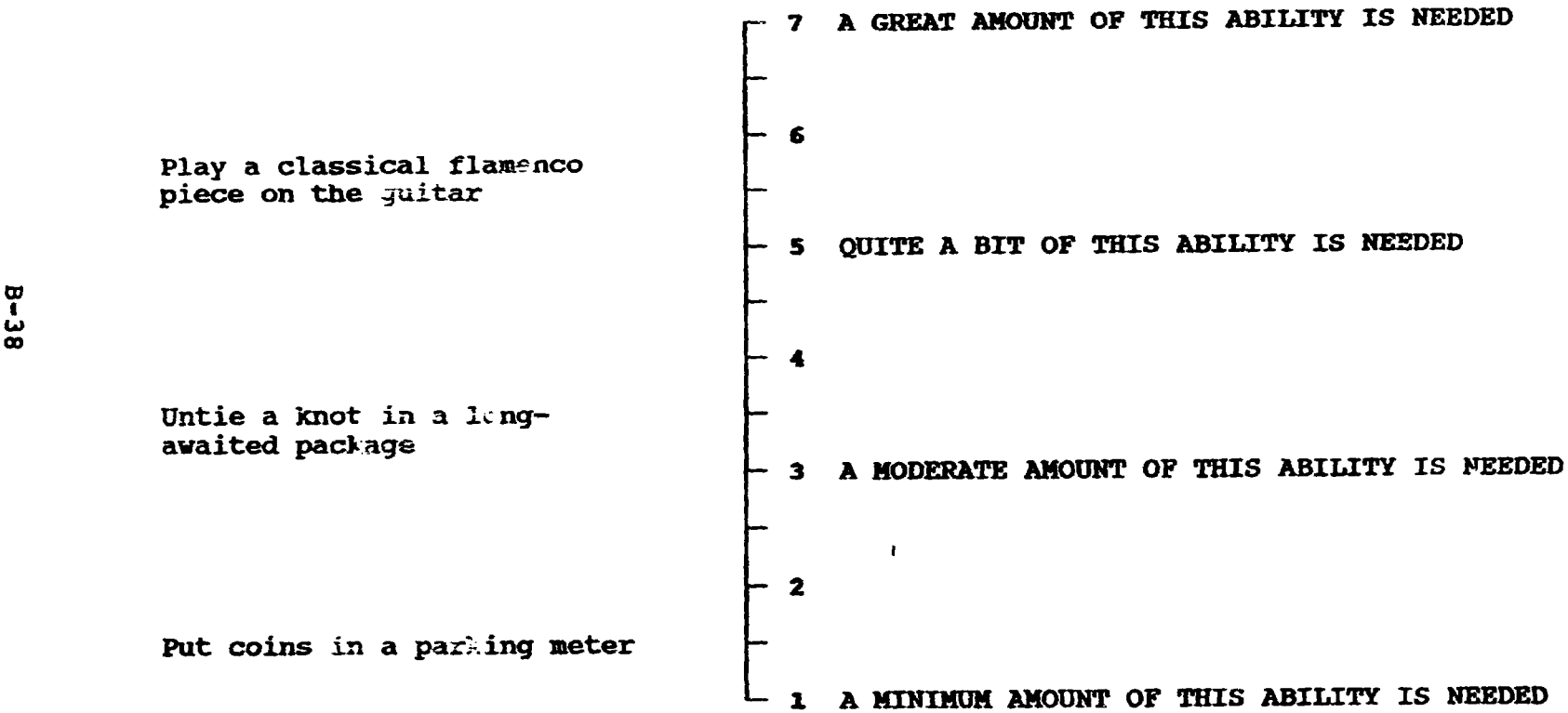
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

36. **WRIST-FINGER SPEED:** The ability to make fast, simple, repeated movements of the fingers, hands, and wrists. It involves little, if any, accuracy or eye-hand coordination.



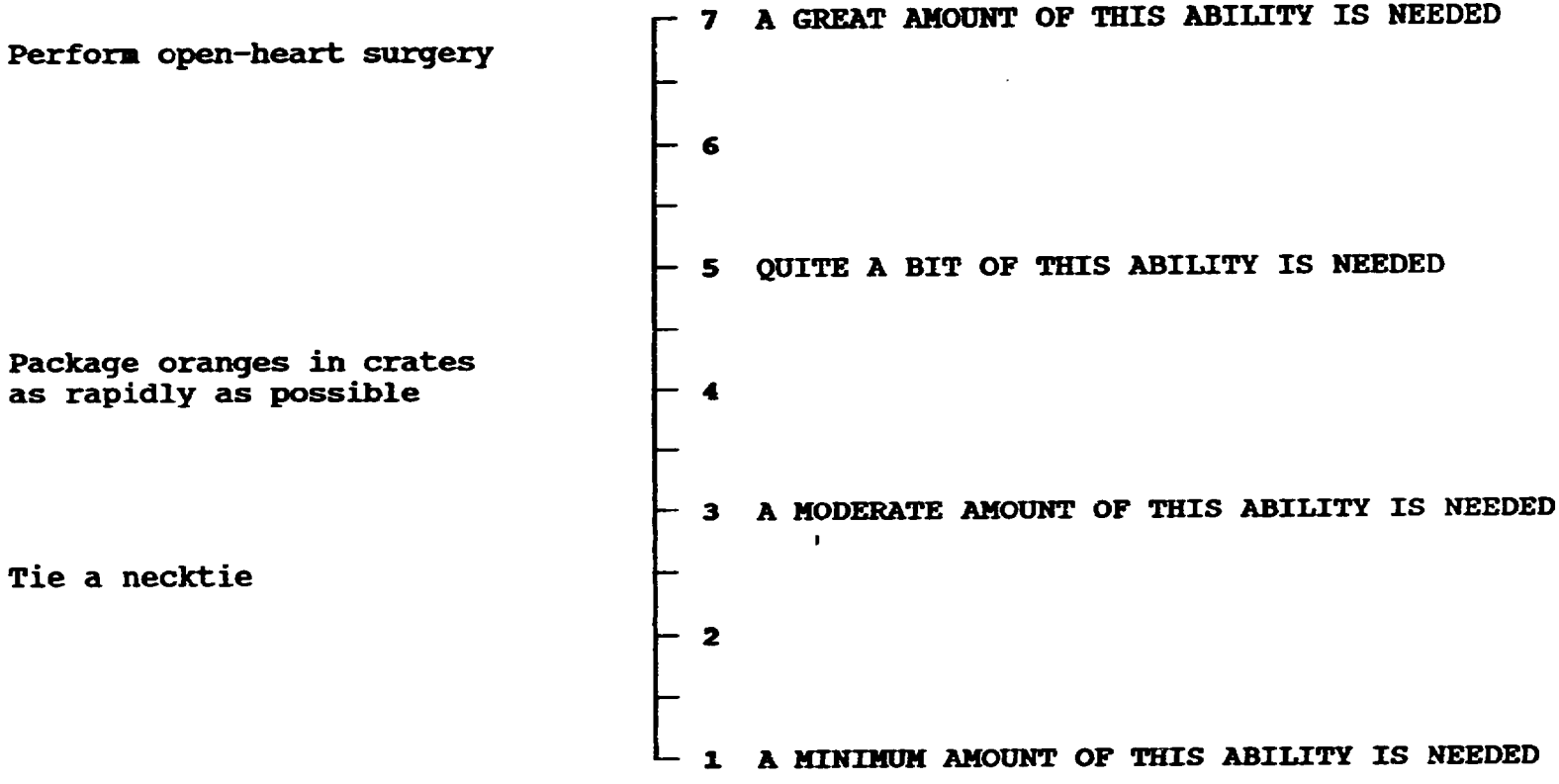
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

37. **FINGER DEXTERITY:** The ability to make skillful, coordinated movements of the fingers of one or both hands and to grasp, place, or move small objects. This ability involves the degree to which these finger movements can be carried out quickly.



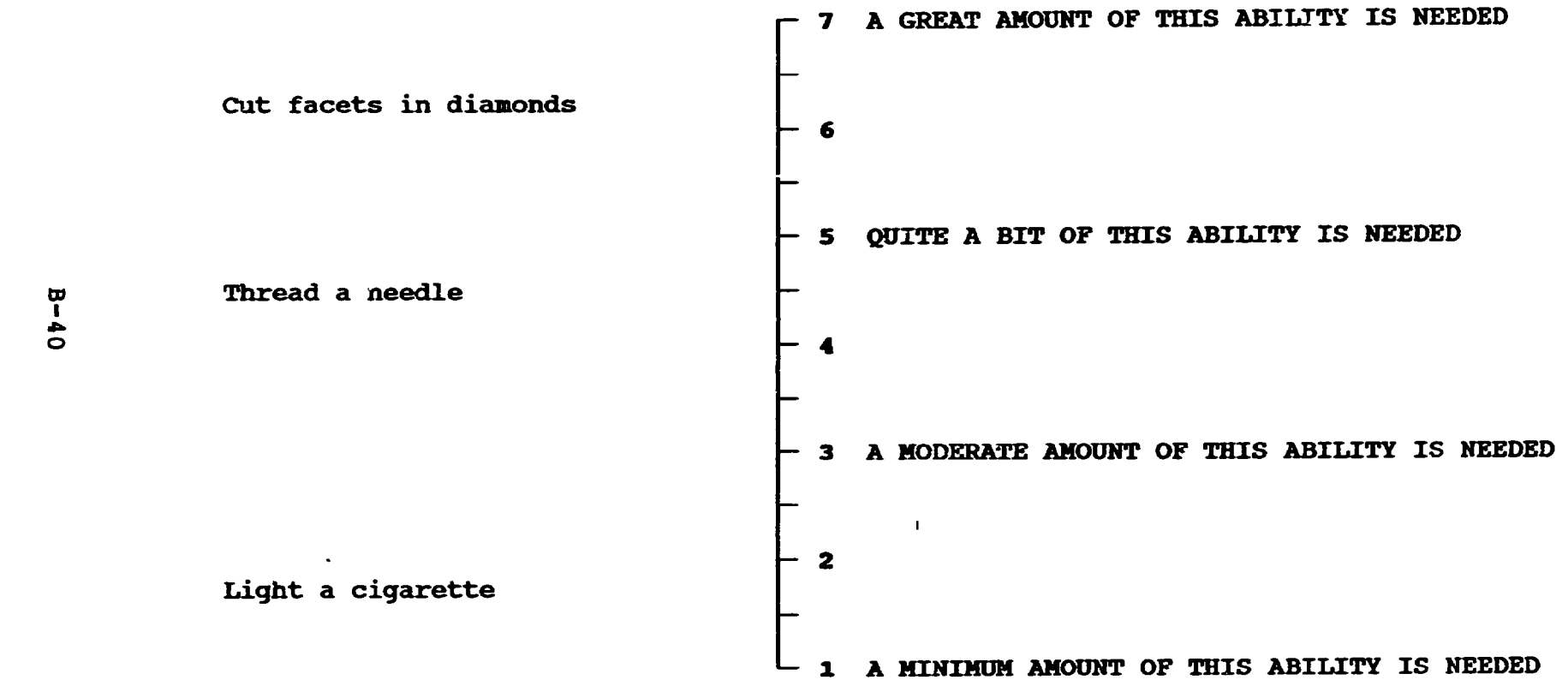
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

38. **MANUAL DEXTERITY:** The ability to make skillful coordinated movements of one hand, a hand together with its arm, or two hands to grasp, place, move, or assemble objects like hand tools or blocks. This ability involves the degree to which these arm-hand movements can be carried out quickly. It does not involve moving machine or equipment controls like levers.



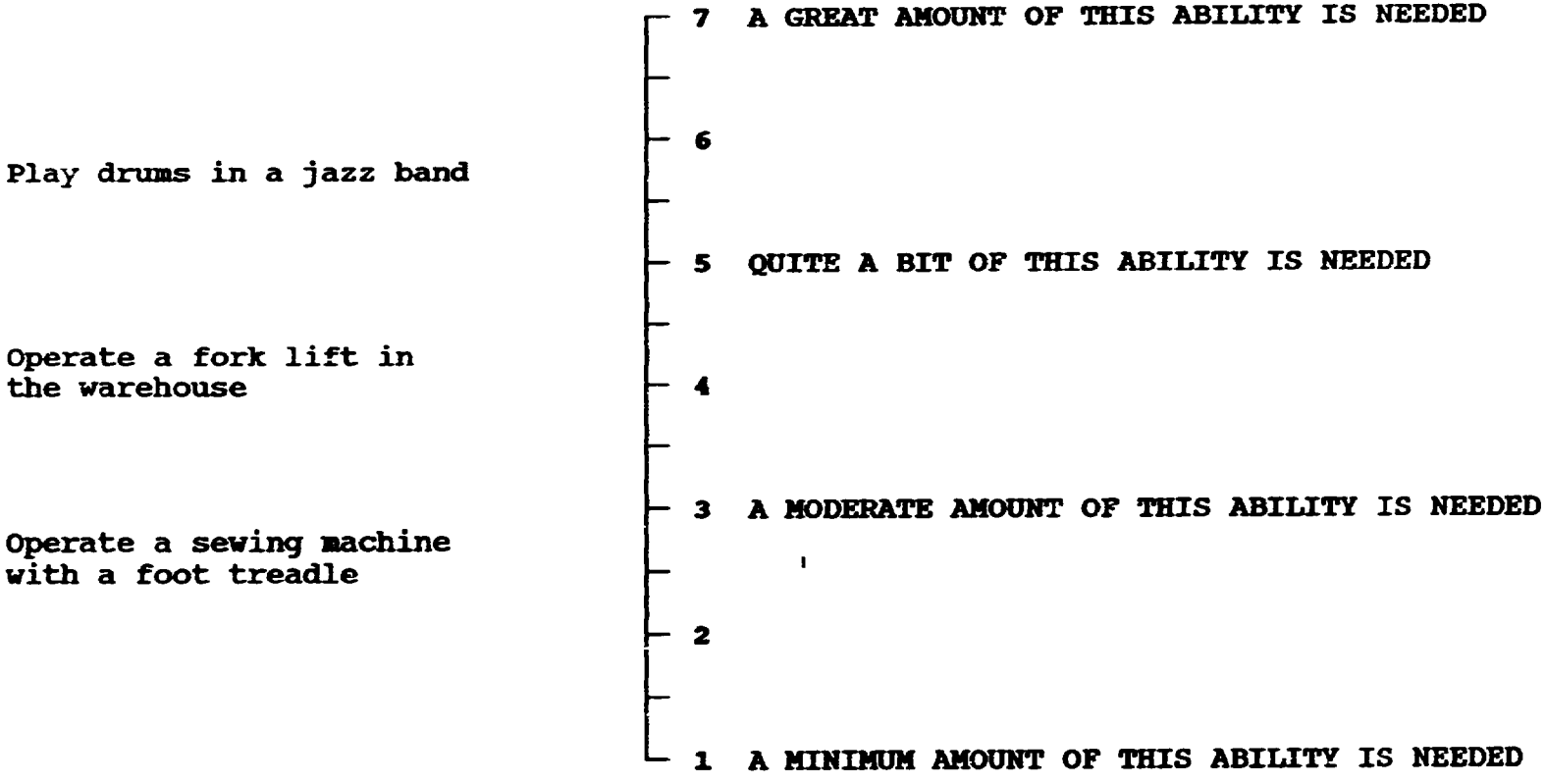
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

39. **ARM-HAND STEADINESS:** The ability to keep the hand and arm steady. It includes steadiness while making an arm movement as well as while holding the arm and hand in one position. This ability does not involve strength or speed.



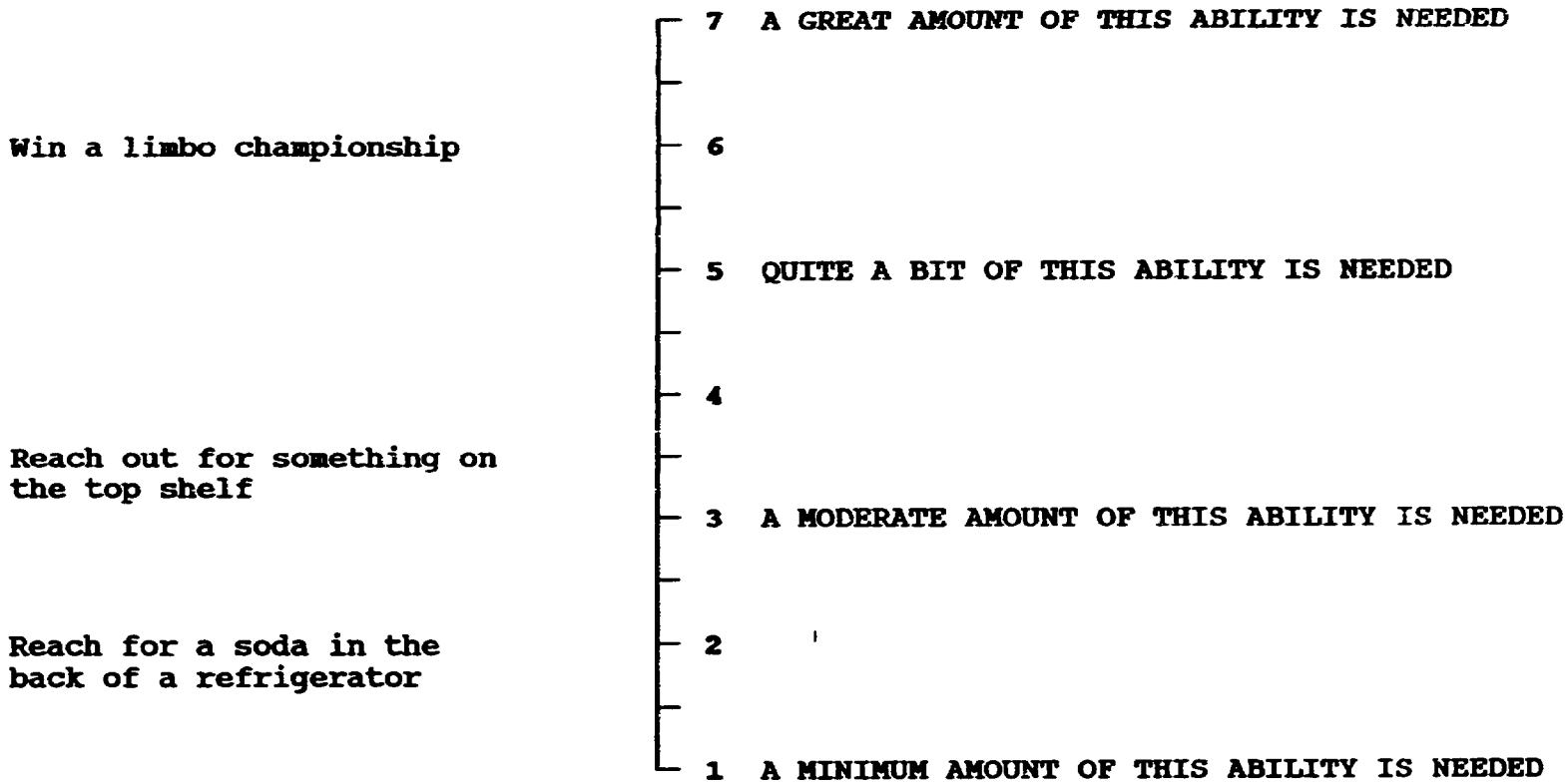
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

40. **MULTI-LIMB COORDINATION:** The ability to coordinate movements of two or more limbs (for example, two legs, or one leg and one arm), such as in moving equipment controls. Two or more limbs are in motion while the individual is sitting, standing, or lying down.



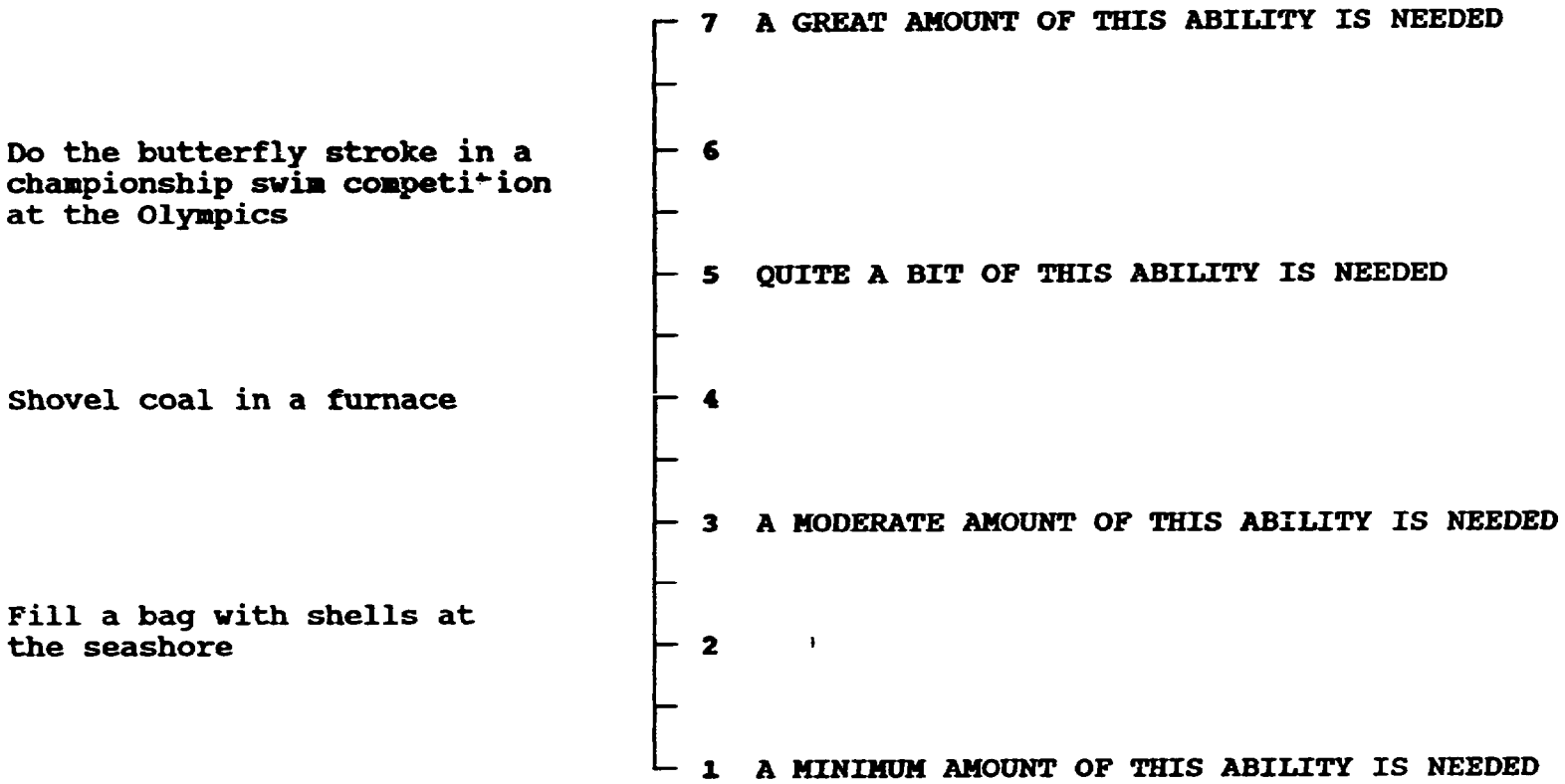
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

41. **EXTENT FLEXIBILITY:** The ability to bend, stretch, twist, or reach out with the body, arms or legs.



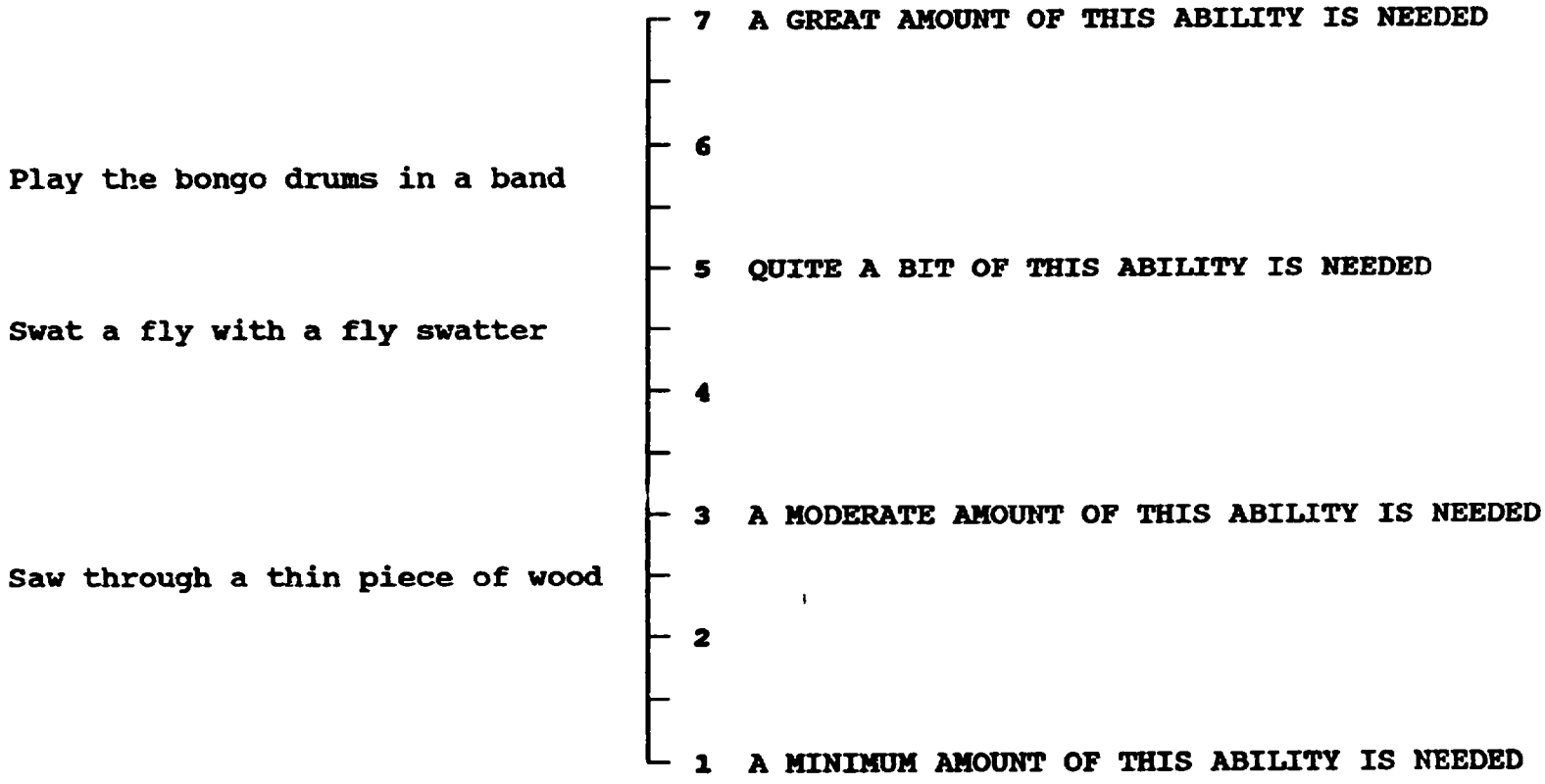
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

42. **DYNAMIC FLEXIBILITY:** The ability to bend, stretch, twist, or reach out with the body, arms, and/or legs, both quickly and repeatedly.



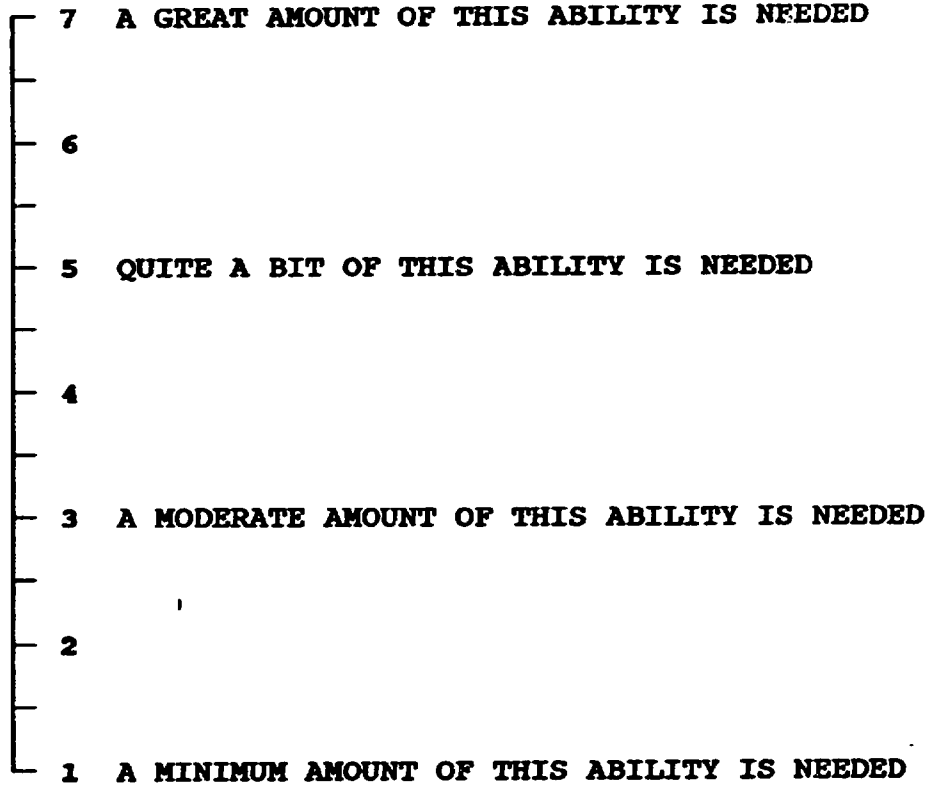
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

43. **SPEED OF LIMB MOVEMENT:** Involves the speed with which a single movement of the arms or legs can be made and/or repeated. This ability does not include accuracy, careful control, or coordination of movement.



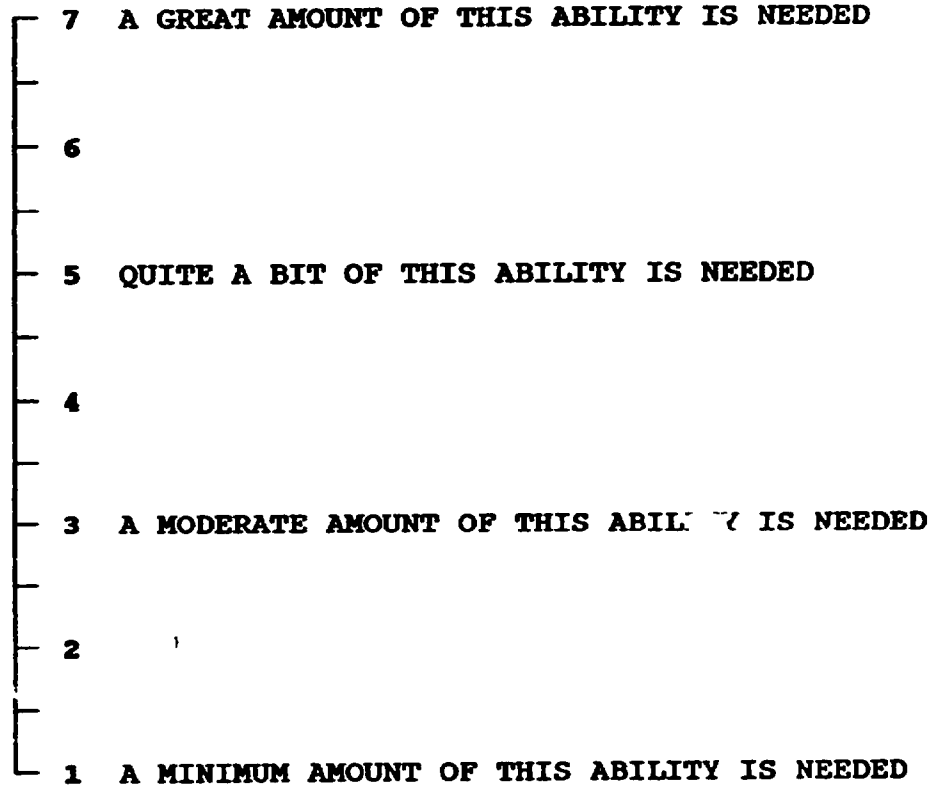
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

44. **GROSS BODY EQUILIBRIUM:** The ability to keep or regain one's body balance or to stay upright when in an unstable position. This ability includes maintaining one's balance when changing direction while moving or standing motionless.



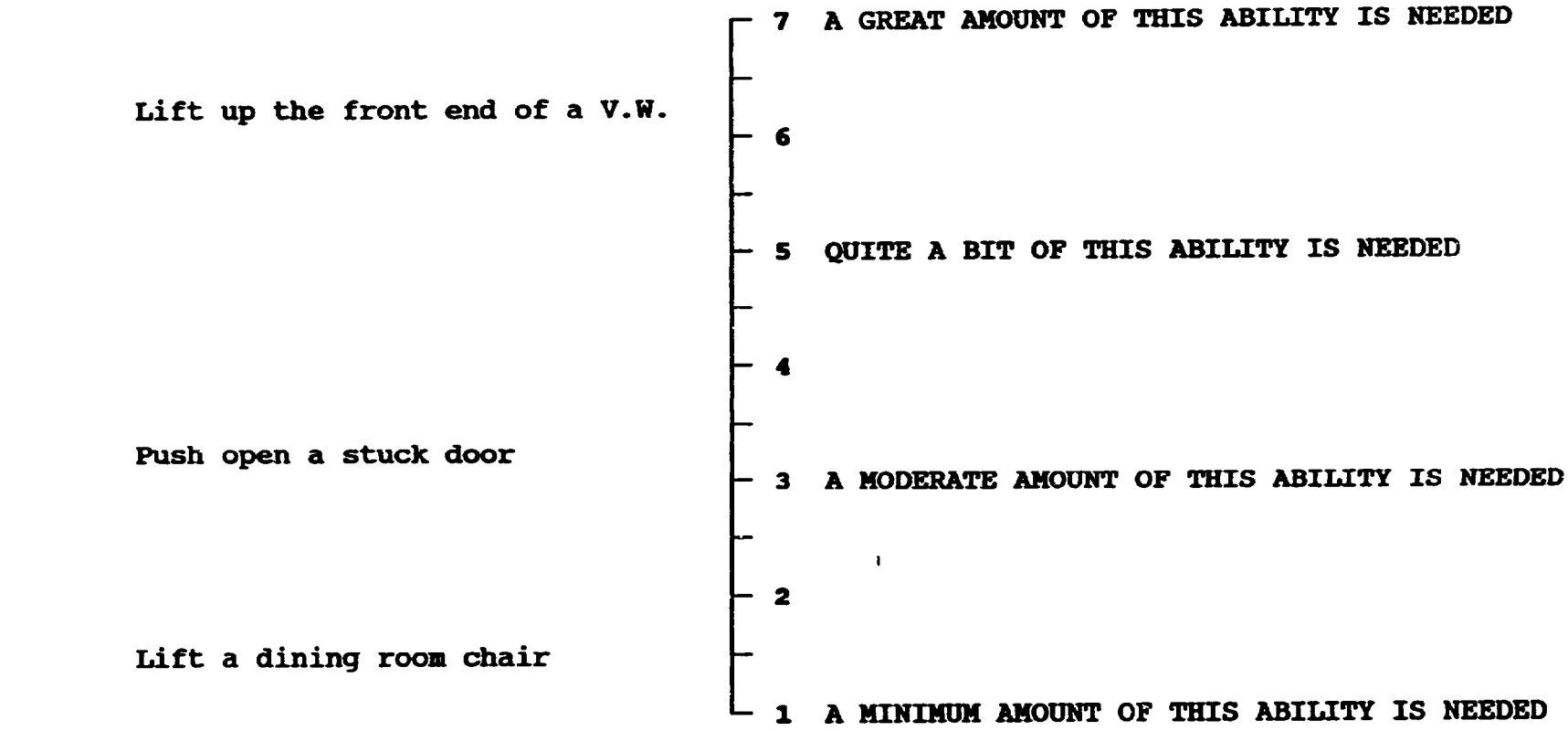
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

45. **GROSS BODY COORDINATION:** The ability to coordinate the movement of the arms, legs, and torso together in activities in which the whole body is in motion.



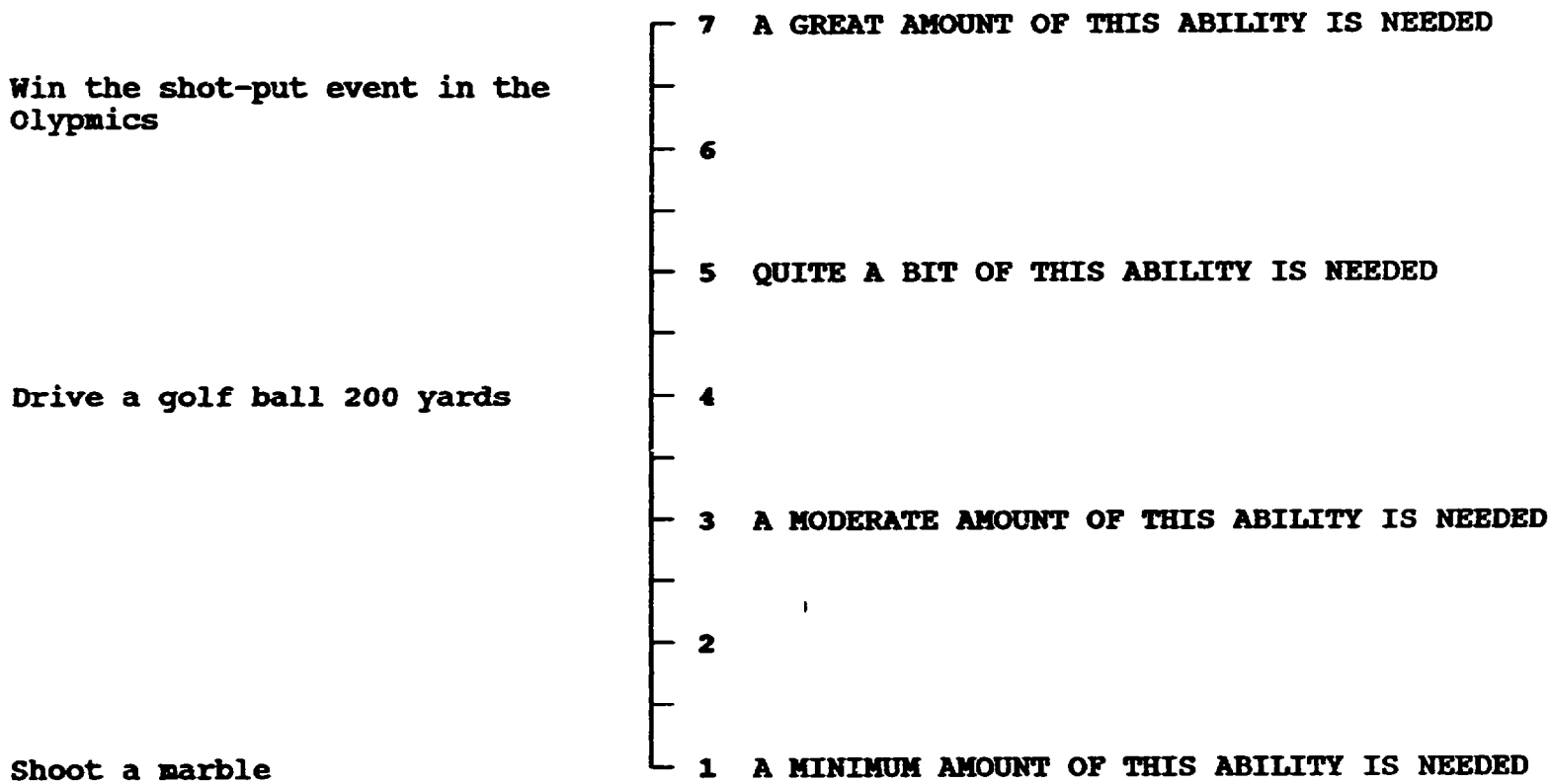
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

46. **STATIC STRENGTH:** The ability to use muscle force in order to lift, push, pull, or carry objects. It is the maximum force that one can exert for a brief period of time.



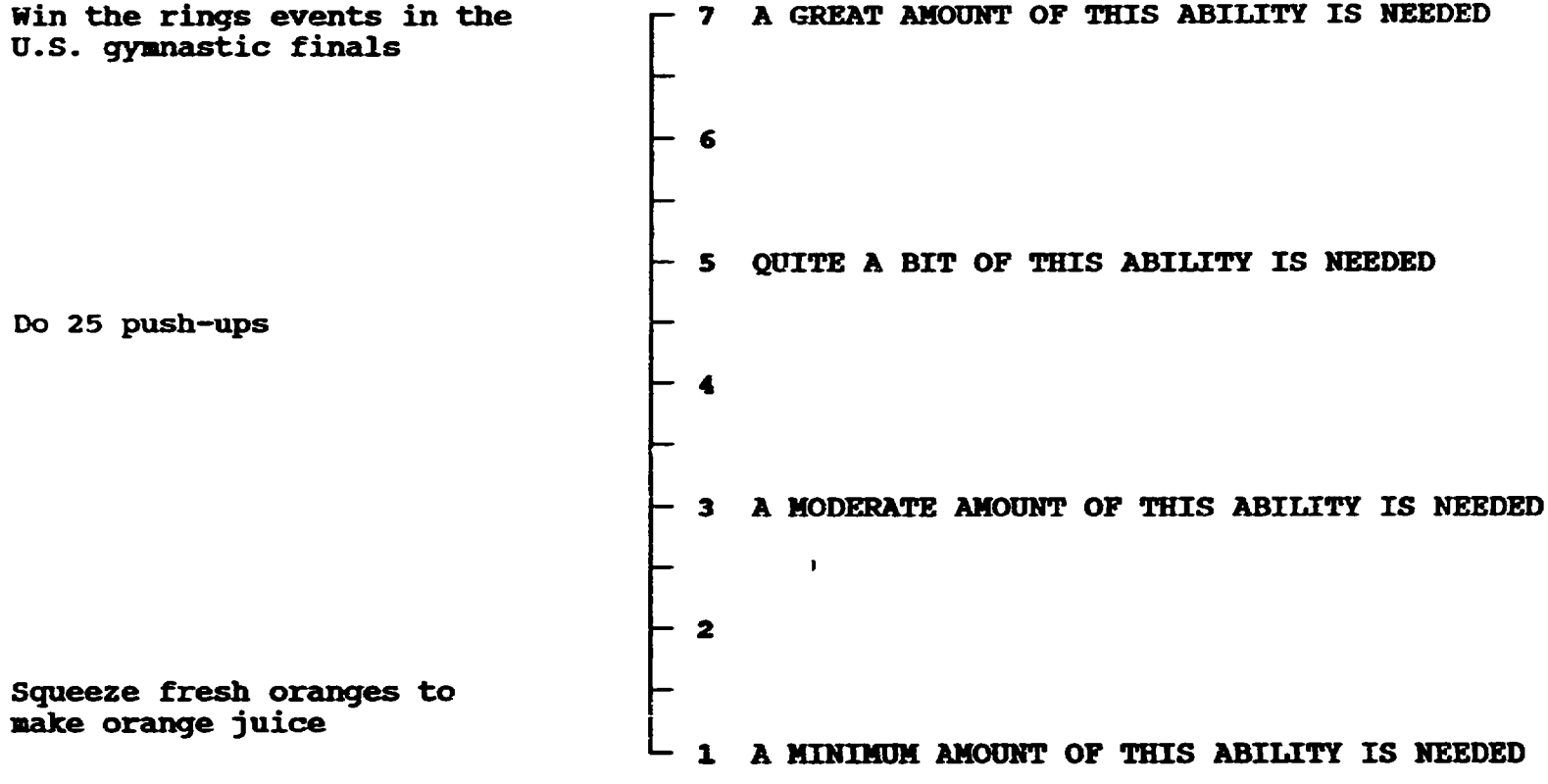
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

47. **EXPLOSIVE STRENGTH:** The ability to use short bursts of muscle force to propel oneself or an object. It requires gathering energy for bursts of muscle effort over a very short time period.



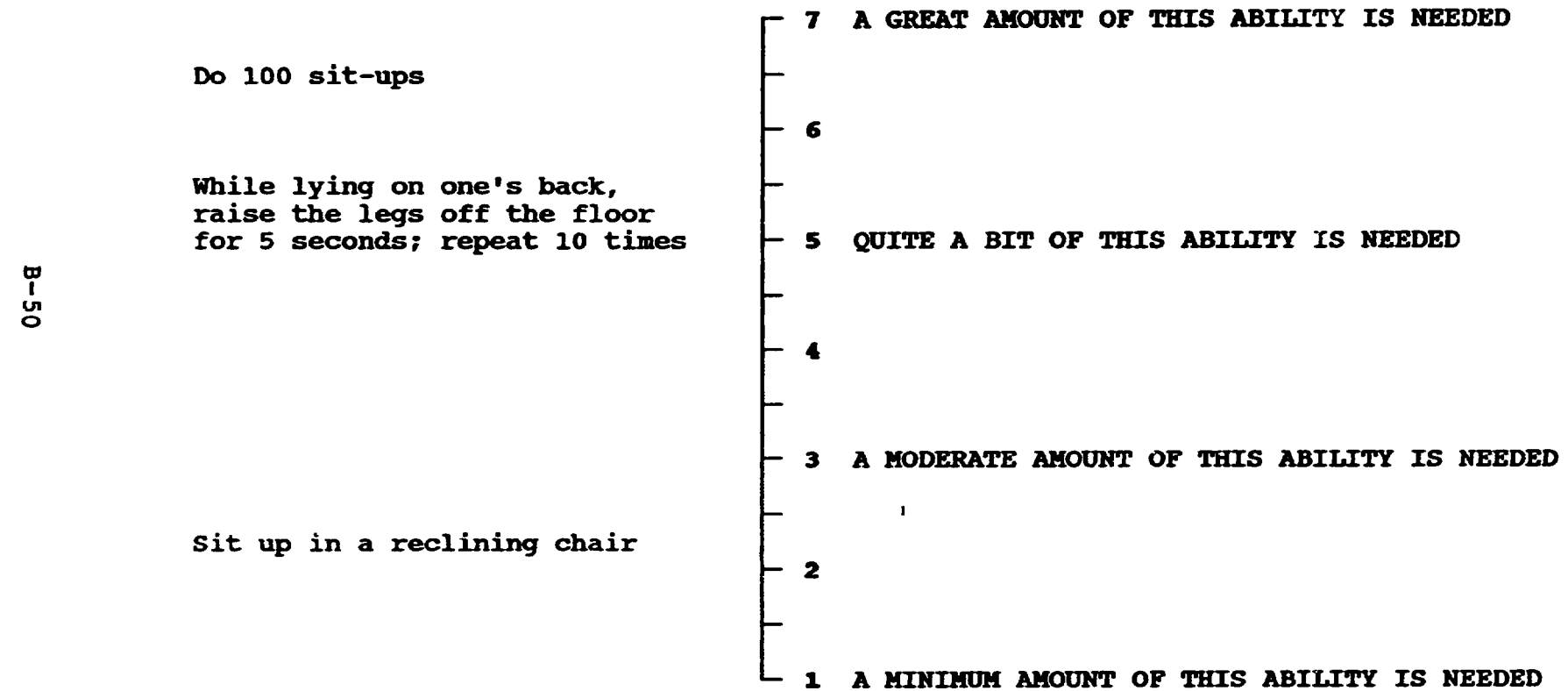
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

48. **DYNAMIC STRENGTH:** The ability of the muscles to exert force repeatedly or continuously over a long time period. This is the ability to support, hold up, or move the body's own weight and/or objects repeatedly over time. It represents muscular endurance and emphasizes the resistance of the muscles to fatigue.



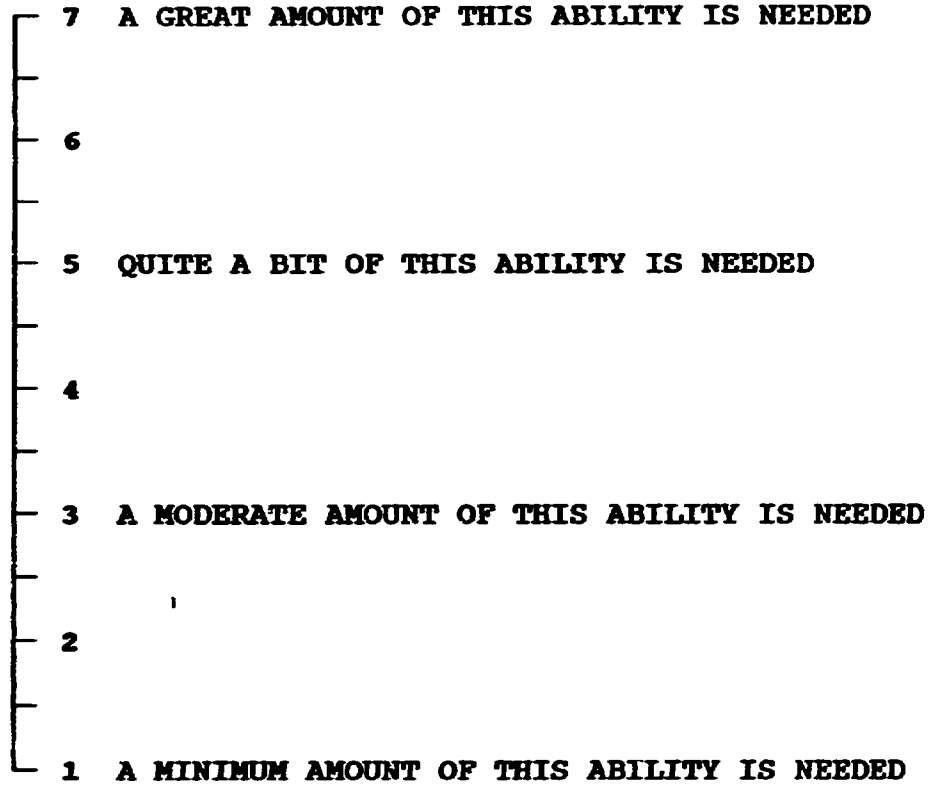
HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

49. **TRUNK STRENGTH:** Involves the degree to which one's stomach and lower back muscles can support part of the body repeatedly or continuously over time. The ability involves the degree to which these trunk muscles do not fatigue when they are put under repeated or continuous strain.



HO MJCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sneet.

50. **STAMINA:** The ability of the lungs and circulatory systems of the body to perform efficiently over long time periods. This is the ability to exert oneself physically without getting out of breath.



HOW MUCH OF THIS ABILITY IS NEEDED FOR THIS JOB OR TASK? Put your number on the answer sheet.

Appendix C

JCAT Part C MI Production Activities

Definitions for JCAT Part C

In Part C of JCAT, you are asked to estimate the amount of the abilities that you selected in Part A of JCAT that are involved in eight intelligence processing activities. These activities are defined as follows:

Planning:

> Any intelligence processing activity or group of activities which involves preparing in advance how you intend to accomplish a task or job function. For example, outlining a set of questions to ask a subject, determining how equipment must be deployed, determining the frequencies to collect on.

Setting-Up or Preparing:

> Any intelligence processing activity or group of activities which must be accomplished before a mission related task can be carried out. For example, deploying equipment, calibrating equipment, collecting information from a data base, preparing a map overlay.

Collecting Data:

> Any intelligence processing activity or group of activities which must be carried out in the collection of data which will later be processed or analyzed by you or someone else. For example, interrogating a subject, listening to and recording voice communications, watching signals on a scope, operating collection equipment.

Managing or Cataloging Data:

> Any intelligence processing activity or group of activities which prepares the collected data for later processing or analysis. For example, using a computer terminal to input data, logging the receipt of a spot report in a journal, placing incoming information on a sitmap.

Analyzing or Exploiting Data:

Any intelligence processing activity or group of activities which requires the processing of collected data or information; to combine it into a higher level of information or to determine the relationships between various types of information. For example, doing intelligence preparation of the battlefield, providing input to an intelligence estimate.

Interpreting Data:

Any intelligence processing activity or group of activities which result in a prediction from or an explanation of a body of previously analyzed data. For example, deriving possible avenues of approach, developing alternative deception strategies, figuring out why the enemy has made an unusual move.

Preparing Outputs:

Any intelligence processing activity or group of activities which requires data or information to be placed in a format. For example, making briefing charts, putting data in message format, encrypting.

Disseminating Information:

Any intelligence processing activity or group of activities which result in the transmission of information or data from one source to another. For example, sending a message by morse code, delivering a briefing, talking on the radio or telephone.

For each of the abilities that you selected in Part A of JCAT, you will determine which of the above intelligence processing activities applies to that ability, based on the definitions of the activities. Then, you will make an estimate of how much of that ability is involved in each of the applicable activities. This estimate is based on a scale like that of Part B of JCAT.

Appendix D

Part A and B Raw Data

96 CMF Test Application

May 1990

MOS 968 Raw and Summary Data.

	MOS 968	YES	MN	SD	56	16	47	36	28	68	53	29	39
1	ORAL COMPREHENSION	9	5.9	1.0	5.0	7.0	7.0	5.5	7.0	7.0	5.0	5.0	5.0
2	WRITTEN COMPREHENSION	9	6.4	0.8	6.0	7.0	7.0	5.5	7.0	7.0	7.0	6.0	5.0
3	ORAL EXPRESSION	9	6.2	0.8	6.0	7.0	7.0	5.5	7.0	7.0	5.0	6.0	5.5
4	WRITTEN EXPRESSION	9	6.0	0.9	6.0	7.0	7.0	5.5	6.5	7.0	4.5	5.0	5.5
5	MEMORIZATION	9	5.6	1.5	3.0	7.0	6.0	4.0	6.5	7.0	5.0	7.0	5.0
6	PROBLEM SENSITIVITY	9	5.1	1.6	3.0	5.0	7.0	3.0	6.5	7.0	5.0	4.0	5.5
7	ORGINALITY	8	4.8	1.3	6.0	3.0	7.0	4.0	5.0	4.0		4.0	5.5
8	FLUENCY OF IDEAS	9	4.8	2.2	1.0	2.0	7.0	5.0	6.5	7.0	3.5	6.0	5.0
9	FLEXIBILITY OF CLOSURE	8	4.9	2.1	2.0	2.0		5.0	7.0	7.0	4.0	6.0	6.5
10	SELECTIVE ATTENTION	8	5.3	1.5	3.0	7.0	6.0	4.0	7.0		4.0	5.0	6.0
11	SPATIAL ORIENTATION	9	5.2	1.4	7.0	5.0	4.0	4.5	6.5	7.0	3.0	5.0	5.0
12	VISUALIZATION	9	5.8	1.4	7.0	6.0	4.0	5.5	6.5	7.0	3.0	7.0	6.5
13	INDUCTIVE REASONING	8	5.3	1.7	3.0	3.0	7.0	6.0		7.0	4.0	6.0	6.5
14	CATEGORY FLEXIBILITY	6	5.2	1.8	4.0	6.0		2.0		7.0		6.0	6.0
15	DEDUCTIVE REASONING	9	5.9	1.3	5.0	3.0	7.0	5.5	6.5	7.0	7.0	6.0	6.5
16	INFORMATION ORDERING	8	5.0	1.7	2.0	3.0		5.0	5.0	7.0	6.0	6.0	6.0
17	MATH REASONING	7	4.5	1.7	3.0	3.0	5.0	2.5		7.0		6.0	5.0
18	NUMBER FACILITY	8	3.9	1.7	1.0	4.0		5.5	2.5	3.0	4.0	6.0	5.0
19	TIME SHARING	8	5.8	1.2	5.0	4.0	7.0	5.0		7.0	5.0	7.0	6.5
20	SPEED OF CLOSURE	8	5.5	2.1	1.0	4.0	7.0	5.5	6.5	7.0		7.0	6.0
21	PERCEPTUAL SPD & ACCY	7	4.4	1.8	1.0	4.0		4.0	6.5		4.0	6.0	5.0
22	REACTION TIME	2	2.5	2.1	1.0	4.0							
23	CHOICE REACTION TIME	4	3.1	1.7	1.0	5.0		3.5					3.0
24	NEAR VISION	6	4.3	1.9	1.0		3.0	5.5			6.0	5.0	5.0
25	FAR VISION	6	4.1	1.7	1.0		3.0	5.5			5.0	5.0	5.0
26	NIGHT VISION	6	3.7	1.5	1.0		3.0	4.0			4.0	5.0	5.0
27	VISUAL COLOR DISC	7	4.2	2.0	4.0	1.0	3.0	4.0			7.0	6.0	4.5
28	PERIPHERAL VISION	5	2.9	1.4	1.0		3.0	2.0				4.0	4.5
29	DEPTH PERCEPTION	6	3.9	1.7	1.0		3.0	5.0			4.0	6.0	4.5
30	GLARE SENSITIVITY	3	3.8	2.6	1.0							6.0	4.5
31	GENERAL HEARING	7	4.1	1.7	1.0	3.0	6.0	4.0			4.0	6.0	4.5
32	AUDITORY ATTENTION	6	5.0	0.6	5.0	5.0	6.0	4.0			5.0		5.0
33	SOUND LOCALIZATION	4	3.4	1.8	1.0	3.0		4.5					5.0
34	CONTROL PRECISION	7	3.6	1.2	1.0	4.0	3.0	4.5			4.0	4.0	4.5
35	RATE CONTROL	2	2.5	2.1	1.0			4.0					
36	WRIST-FINGER SPEED	5	3.6	1.5	1.0	5.0		4.0				4.0	4.0
37	FINGER DEXTERITY	8	4.7	1.4	3.0	5.0	4.5	4.0	3.0		7.0	6.0	5.0
38	MANUAL DEXTERITY	6	4.8	1.1	3.0		4.5	4.5			6.0	6.0	5.0
39	ARM-HAND STEADINESS	6	4.5	1.8	1.0			5.0	5.0		5.0	6.0	5.0
40	MULTI-LIMB COORDINATION	5	4.1	1.9	1.0			4.5			4.0	6.0	5.0
41	EXTENT FLEXIBILITY	6	4.1	1.8	1.0			5.0	3.0		5.0	6.0	4.5
42	DYNAMIC FLEXIBILITY	4	3.4	1.8	1.0	3.0		5.0					4.5
43	SPD OF LIMB MOVEMENT	4	3.5	2.1	1.0	3.0		4.0				6.0	
44	GROSS BODY EQUILIBRIUM	4	2.8	1.5	1.0				2.0		4.0		4.0
45	GROSS BODY COORDINATN	6	4.2	1.9	1.0	3.0		5.5			5.0	6.0	4.5
46	STATIC STRENGTH	7	4.0	1.4	2.0	2.0	5.0	5.5			4.0	5.0	4.5
47	EXPLOSIVE STRENGTH	3	3.7	2.3	1.0		5.0					5.0	
48	DYNAMIC STRENGTH	4	3.8	2.1	1.0				4.0		4.0	6.0	
49	TRUNK STRENGTH	4	4.0	2.2	1.0				4.0		5.0	6.0	
50	STAMINA	6	4.3	2.5	1.0	7.0		5.0	2.0		4.0	7.0	

MOS 96D RAW AND SUMMARY DATA

	MOS 96D	YES	MN	SD	8	6	5	9	7	45	46	59	42	33
1	ORAL COMPREHENSION	10	5.1	1.0	5.0	4.0	6.0	5.0	5.0	7.0	4.0	5.5	5.0	4.0
2	WRITTEN COMPREHENSION	10	5.8	0.8	7.0	6.0	6.0	5.5	5.0	7.0	5.0	5.5	6.0	5.1
3	ORAL EXPRESSION	9	5.8	0.9		4.0	6.0	6.0	5.0	7.0	5.0	6.5	4.0	6.0
4	WRITTEN EXPRESSION	10	5.7	0.8	7.0	6.0	5.0	6.0	5.0	7.0	5.0	5.0	5.0	6.0
5	MEMORIZATION	9	5.5	1.4	5.0	7.0	4.0		5.0	6.0	3.0	5.5	7.0	7.0
6	PROBLEM SENSITIVITY	8	5.8	1.0	5.0	6.0		4.0	5.0	6.0		6.0	7.0	7.0
7	ORGINALITY	5	5.0	0.9			5.0	4.5	5.0	4.0		6.5		
8	FLUENCY OF IDEAS	3	4.7	0.6					5.0	5.0		4.0		
9	FLEXIBILITY OF CLOSURE	7	5.7	1.0			4.0		6.0	6.5	6.0	5.5	5.0	7.0
10	SELECTIVE ATTENTION	9	5.3	1.0	5.0		4.0	5.0	6.0	5.0	4.0	6.5	6.5	6.0
11	SPATIAL ORIENTATION	9	5.3	1.4		7.0	6.0	5.0	4.5	5.0	2.0	6.0	6.0	6.0
12	VISUALIZATION	7	5.6	1.0		7.0	6.0		4.5	6.0		6.0	4.0	6.0
13	INDUCTIVE REASONING	8	5.6	1.3	7.0		6.0	6.0	4.0	6.0	3.0	6.5		6.0
14	CATEGORY FLEXIBILITY	7	4.2	1.2			4.0	6.5	3.0	4.0	3.0	4.0		5.0
15	DEDUCTIVE REASONING	9	5.6	1.3	7.0	7.0	6.5	3.5	5.0	6.0	4.0	5.0		6.0
16	INFORMATION ORDERING	9	4.8	1.3		6.0	6.0	4.5	5.0	6.0	3.0	5.5	2.5	5.0
17	MATH REASONING	9	5.4	1.3	7.0	7.0	5.0		5.0	7.0	5.0	5.0	3.0	5.0
18	NUMBER FACILITY	10	5.1	1.7	7.0	7.0	6.0	3.0	5.0	7.0	4.0	5.0	2.5	4.0
19	TIME SHARING	8	4.9	0.9		4.0	6.5	4.5	5.0	5.0	4.0	6.0	4.5	
20	SPEED OF CLOSURE	6	5.1	1.2		3.0			5.0	6.0	5.0	6.5		5.0
21	PERCEPTUAL SPD & ACCY	10	5.1	1.3	5.0	5.0	6.0	4.5	3.0	6.0	3.0	6.5	7.0	5.0
22	REACTION TIME	5	4.2	1.2		5.0				3.0		5.5	4.5	3.0
23	CHOICE REACTION TIME	4	4.4	1.1						3.0		5.5	4.0	5.0
24	NEAR VISION	10	6.3	0.8	7.0	7.0	6.5	6.5	7.0	7.0	5.0	5.5	6.0	5.0
25	FAR VISION	9	5.9	0.9	7.0	7.0	5.5	6.0		5.0	5.0	5.5	7.0	5.0
26	NIGHT VISION	8	5.4	1.1	7.0	7.0	5.0			5.0	4.0	5.5	5.0	5.0
27	VISUAL COLOR DISC	8	6.0	1.1	7.0	7.0	5.0		5.0	7.0	5.0	5.0	7.0	
28	PERIPHERAL VISION	6	5.4	1.4		7.0				6.0	3.0	6.5	5.0	5.0
29	DEPTH PERCEPTION	10	6.3	0.9	7.0	7.0	5.0	7.0	6.0	7.0	5.0	6.5	7.0	5.0
30	GLARE SENSITIVITY	7	5.6	1.5	7.0	7.0	4.5			6.0		5.0	7.0	3.0
31	GENERAL HEARING	2	5.0	0.0						5.0		5.0		
32	AUDITORY ATTENTION	2	5.0	0.0						5.0		5.0		
33	SOUND LOCALIZATION	2	4.5	0.7						4.0		5.0		
34	CONTROL PERCISION	7	5.3	1.1	5.0		6.0	4.0		6.0		5.0	7.0	4.0
35	RATE CONTROL	3	5.2	1.3						5.0		4.0	6.5	
36	WRIST-FINGER SPEED	4	4.5	1.0			5.0			5.0		5.0		3.0
37	FINGER DEXTERITY	3	4.8	0.3			4.5			5.0		5.0		
38	MANUAL DEXTERITY	4	4.6	1.1			5.5			5.0	3.0	5.0		
39	ARM-HAND STEADINESS	5	4.8	1.1			5.0			6.0		5.0	5.0	3.0
40	MULTI-LIMB COORDINATION	5	3.8	1.8			5.0			5.0		5.0	3.0	1.0
41	EXTENT FLEXIBILITY	3	4.7	0.6			5.0			4.0		5.0		
42	DYNAMIC FLEXIBILITY	2	4.0	0.0						4.0		4.0		
43	SPD OF LIMB MOVEMENT	2	4.5	0.7						4.0		5.0		
44	GROSS BODY EQUILIBRIUM	3	4.0	1.0			5.0			3.0		4.0		
45	GROSS BODY COORDINATN	2	4.0	1.4			5.0			3.0				
46	STATIC STRENGTH	3	3.5	0.5			4.0			3.0		3.5		
47	EXPLOSIVE STRENGTH	3	4.2	1.0			5.0			3.0		4.5		
48	DYNAMIC STRENGTH	3	4.8	1.8			5.0			3.0		6.5		
49	TRUNK STRENGTH	3	4.7	1.5			5.0			3.0		6.0		
50	STAMINA	3	4.2	1.0			5.0			3.0		4.5		

MOS 96H RAW AND SUMMARY DATA

	MOS 96H	YES	MN	SD	50	75	76	24	77	71	30	37
1	ORAL COMPREHENSION	7	5.9	1.1	6.0		5.0	7.0	4.0	6.0	6.0	7.0
2	WRITTEN COMPREHENSION	7	5.7	1.5	7.0		5.0	7.0	3.0	6.0	5.0	7.0
3	ORAL EXPRESSION	7	5.7	1.0	6.0		5.0	7.0	5.0	5.0	5.0	7.0
4	WRITTEN EXPRESSION	7	5.0	1.5	5.0		5.0	7.0	3.0	4.0	4.0	7.0
5	MEMORIZATION	8	4.7	1.5	4.5	2.0	4.0	7.0	4.0	5.0	5.0	6.0
6	PROBLEM SENSITIVITY	8	5.4	1.6	7.0	3.0	5.0	6.0	4.0	7.0	4.0	7.0
7	ORGINALITY	6	3.3	1.9		2.0	2.0		3.0	3.0	3.0	7.0
8	FLUENCY OF IDEAS	7	4.2	2.2	5.5		2.0	6.0	4.0	1.0	4.0	7.0
9	FLEXIBILITY OF CLOSURE	8	5.7	1.5	6.0	7.0	5.5	7.0	4.0	3.0	6.0	7.0
10	SELECTIVE ATTENTION	8	5.8	1.3	5.5	4.0	6.0	7.0	4.0	7.0	6.0	7.0
11	SPATIAL ORIENTATION	8	6.6	0.7	7.0	7.0	5.0	7.0	6.0	7.0	7.0	7.0
12	VISUALIZATION	6	5.4	1.5	5.5		3.0	7.0	5.0		7.0	5.0
13	INDUCTIVE REASONING	7	4.9	1.2	6.0		4.5	7.0	4.0	4.0	4.0	5.0
14	CATEGORY FLEXIBILITY	4	3.3	1.7			1.0		4.0		3.0	5.0
15	DEDUCTIVE REASONING	7	5.1	1.9	6.0		2.0	7.0	4.0	6.0	4.0	7.0
16	INFORMATION ORDERING	7	5.3	1.5	6.5		4.5	6.0	3.0	6.0	4.0	7.0
17	MATH REASONING	8	4.1	1.1	3.5	3.0	3.0	6.0	5.0	4.0	5.0	3.0
18	NUMBER FACILITY	8	4.9	1.2	5.0	4.0	3.0	7.0	5.0	6.0	5.0	4.0
19	TIME SHARING	8	5.3	1.6	5.0	4.0	3.0	7.0	4.0	7.0	5.0	7.0
20	SPEED OF CLOSURE	7	4.4	1.0	4.0	5.0	3.0		4.0	4.0	6.0	5.0
21	PERCEPTUAL SPD & ACCY	7	5.2	1.4	6.5		5.0	6.0	3.0	7.0	4.0	5.0
22	REACTION TIME	6	5.8	0.8	6.0		5.0	7.0	5.0		6.0	6.0
23	CHOICE REACTION TIME	7	5.2	1.6	5.0	2.0	5.0		5.0	6.5	7.0	6.0
24	NEAR VISION	8	6.0	1.4	7.0	3.0	5.0	7.0	6.0	7.0	6.0	7.0
25	FAR VISION	8	6.8	0.7	7.0	7.0	5.0	7.0	7.0	7.0	7.0	7.0
26	NIGHT VISION	8	6.6	0.7	7.0	6.0	5.0	7.0	7.0	7.0	7.0	7.0
27	VISUAL COLOR DISC	8	5.8	1.3	7.0	4.0	4.0	5.0	6.0	7.0	6.0	7.0
28	PERIPHERAL VISION	8	6.1	1.1	7.0	5.0	4.5	7.0	6.0	7.0	5.0	7.0
29	DEPTH PERCEPTION	8	6.0	1.5	7.0	5.0	3.0	7.0	7.0	5.0	7.0	7.0
30	GLARE SENSITIVITY	8	5.8	1.0	6.0	5.0	4.0	7.0	6.0	5.0	6.0	7.0
31	GENERAL HEARING	8	5.6	1.2	6.0	4.0	4.0	7.0	5.0	5.5	6.0	7.0
32	AUDITORY ATTENTION	7	6.0	1.0	6.0		5.5	7.0	4.0	6.5	6.0	7.0
33	SOUND LOCALIZATION	6	4.4	1.7	4.5		2.0	5.0	3.0		5.0	7.0
34	CONTROL PERCISION	8	5.5	1.5	6.0	3.0	4.0	7.0	5.0	7.0	5.0	7.0
35	RATE CONTROL	7	5.4	1.3	6.0	4.0	5.0		4.0	7.0	5.0	7.0
36	WRIST-FINGER SPEED	5	4.8	1.5	5.0		3.0		4.0		5.0	7.0
37	FINGER DEXTERITY	7	5.6	1.1	6.0		5.0	7.0	4.0	5.0	5.0	7.0
38	MANUAL DEXTERITY	6	5.3	1.0	6.0		5.0		4.0	5.0	5.0	7.0
39	ARM-HAND STEADINESS	7	5.0	1.5	4.0		5.0	7.0	3.0	4.0	5.0	7.0
40	MULTI-LIMB COORDINATION	7	4.3	1.8	6.0	2.0	3.0		3.0	4.0	5.0	7.0
41	EXTENT FLEXIBILITY	7	4.9	1.3	4.0		5.0	6.0	3.0	4.0	5.0	7.0
42	DYNAMIC FLEXIBILITY	7	4.3	1.7	5.5		3.5	5.0	4.0	2.0	3.0	7.0
43	SPD OF LIMB MOVEMENT	5	5.6	1.[illegible]			6.0	6.0	4.0		5.0	7.0
44	GROSS BODY EQUILIBRIUM	6	4.6	1.[illegible]	5.5		2.0		4.0	4.0	5.0	7.0
45	GROSS BODY COORDINATN	5	4.7	1.6	5.5		3.0		4.0		4.0	7.0
46	STATIC STRENGTH	7	5.1	0.7	4.5		6.0	5.0	5.0	4.0	5.0	6.0
47	EXPLOSIVE STRENGTH	6	4.5	1.5	4.0		6.0		6.0	2.0	4.0	5.0
48	DYNAMIC STRENGTH	6	4.3	0.9	5.5		4.0	4.0	3.0		5.0	4.0
49	TRUNK STRENGTH	6	5.2	1.0	6.0		4.0	6.0	6.0		5.0	4.0
50	STAMINA	6	4.4	1.5	4.5		2.0	6.0	6.0		4.0	4.0

	MOS 96R	YES	MN	SD	11	12	13	14	15	34	35	63	62
1	ORAL COMPREHENSION	9	5.9	0.9	6.0	5.0	5.0	7.0	5.0	5.0	7.0	7.0	6.0
2	WRITTEN COMPREHENSION	9	5.6	1.2	6.0	4.0	5.0	7.0	5.0	4.0	7.0	7.0	5.0
3	ORAL EXPRESSION	9	5.8	1.4	7.0	5.0	5.0	7.0	3.0	5.0	7.0	7.0	6.0
4	WRITTEN EXPRESSION	7	5.6	1.3	6.0	4.0	4.0	7.0			6.0	7.0	5.0
5	MEMORIZATION	9	5.6	2.1	6.0	4.0	7.0	7.0	1.0	4.0	7.0	7.0	7.0
6	PROBLEM SENSITIVITY	9	5.3	1.6	7.0	5.0	5.0	6.0	3.0	3.0	7.0	7.0	5.0
7	ORGINALITY	8	5.6	1.4	7.0	3.0	5.0	6.0	5.0		7.0	5.0	7.0
8	FLUENCY OF IDEAS	8	5.1	0.6	5.0	4.0	5.0	6.0	5.0		6.0	5.0	5.0
9	FLEXIBILITY OF CLOSURE	9	5.4	1.7	7.0	3.0	4.0	7.0	3.0	5.0	7.0	6.0	7.0
10	SELECTIVE ATTENTION	9	5.7	2.1	6.0	4.0	7.0	7.0	1.0	5.0	7.0	7.0	7.0
11	SPATIAL ORIENTATION	9	5.8	1.5	7.0	5.0	7.0	7.0	3.0	5.0	7.0	7.0	4.5
12	VISUALIZATION	9	5.1	1.6	6.0	3.0	7.0	7.0	3.0	4.0	6.0	4.0	6.0
13	INDUCTIVE REASONING	8	5.5	1.2	7.0	4.0	6.0	5.0	5.0		7.0	6.0	4.0
14	CATEGORY FLEXIBILITY	8	4.3	1.8	5.0	3.0	5.0	5.0	1.0		7.0	5.0	3.0
15	DEDUCTIVE REASONING	9	4.6	1.8	6.0	4.0	5.0	6.0	1.0	3.0	7.0	5.0	4.0
16	INFORMATION ORDERING	8	5.1	1.8	6.0	5.0	5.0	6.0	1.0		6.0	7.0	5.0
17	MATH REASONING	9	5.1	1.7	7.0	3.0	4.0	6.0	3.0	4.0	7.0	7.0	5.0
18	NUMBER FACILITY	9	5.1	2.0	7.0	4.0	4.0	6.0	1.0	4.0	7.0	7.0	6.0
19	TIME SHARING	9	5.0	2.1	6.0	3.0	5.0	7.0	1.0	4.0	7.0	7.0	5.0
20	SPEED OF CLOSURE	9	5.3	1.7	7.0	4.0	4.0	7.0	3.0	4.0	7.0	5.0	7.0
21	PERCEPTUAL SPD & ACCY	9	5.2	1.6	7.0	4.0	5.0	6.0	3.0	4.0	7.0	7.0	4.0
22	REACTION TIME	9	5.7	2.0	7.0	5.0	7.0	7.0	1.0	5.0	7.0	7.0	5.0
23	CHOICE REACTION TIME	8	6.4	0.7	7.0	6.0	6.0	7.0		5.0	7.0	7.0	6.0
24	NEAR VISION	9	5.3	1.9	5.0	5.0	7.0	6.0	1.0	4.0	7.0	6.0	7.0
25	FAR VISION	9	5.4	1.9	7.0	5.0	7.0	6.0	1.0	4.0	7.0	6.0	6.0
26	NIGHT VISION	9	6.2	1.4	7.0	6.0	7.0	7.0	3.0	5.0	7.0	7.0	7.0
27	VISUAL COLOR DISC	7	5.4	1.5	6.0	3.0	5.0	6.0			7.0	7.0	4.0
28	PERIPHERAL VISION	9	4.9	2.2	7.0	4.0	7.0	6.0	1.0	3.0	7.0	6.0	3.0
29	DEPTH PERCEPTION	9	4.9	2.2	7.0	3.0	6.0	6.0	1.0	4.0	7.0	7.0	3.0
30	GLARE SENSITIVITY	8	5.4	1.6	7.0	4.0	5.0	6.0	3.0		7.0	7.0	4.0
31	GENERAL HEARING	9	6.4	0.9	7.0	7.0	6.0	7.0	5.0	5.0	7.0	7.0	7.0
32	AUDITORY ATTENTION	9	6.3	1.0	7.0	7.0	5.0	7.0	5.0	5.0	7.0	7.0	7.0
33	SOUND LOCALIZATION	8	5.9	2.2	7.0	7.0	7.0	7.0	1.0		7.0	7.0	4.0
34	CONTROL PRECISION	9	5.4	2.0	7.0	4.0	5.0	7.0	1.0	5.0	7.0	7.0	6.0
35	RATE CONTROL	9	5.6	1.4	6.0	4.0	5.0	7.0	3.0	5.0	6.0	7.0	7.0
36	WRIST-FINGER SPEED	9	5.3	2.1	6.0	3.0	7.0	7.0	1.0	5.0	6.0	7.0	6.0
37	FINGER DEXTERITY	9	5.6	1.9	6.0	5.0	7.0	7.0	1.0	5.0	6.0	7.0	6.0
38	MANUAL DEXTERITY	9	5.3	1.8	6.0	5.0	5.0	7.0	1.0	5.0	6.0	7.0	6.0
39	ARM-HAND STEADINESS	8	5.4	1.1	5.0	6.0	6.0	5.0		4.0	6.0	7.0	4.0
40	MULTI-LIMB COORDINATION	8	5.9	1.1	7.0	6.0	7.0	7.0		4.0	6.0	5.0	5.0
41	EXTENT FLEXIBILITY	7	5.9	1.1	6.0	5.0	6.0	7.0			7.0	6.0	4.0
42	DYNAMIC FLEXIBILITY	7	5.9	0.9	7.0	5.0	6.0	6.0			7.0	5.0	5.0
43	SPD OF LIMB MOVEMENT	9	4.9	2.0	6.0	5.0	6.0	7.0	1.0	5.0	7.0	3.0	4.0
44	GROSS BODY EQUILIBRIUM	8	5.6	1.2	7.0	5.0	6.0	4.0		4.0	6.0	7.0	6.0
45	GROSS BODY COORDINATN	7	5.7	1.5	6.0	5.0	7.0	7.0			7.0	3.0	5.0
46	STATIC STRENGTH	9	5.0	1.9	7.0	4.0	4.0	6.0	1.0	5.0	7.0	6.0	5.0
47	EXPLOSIVE STRENGTH	8	4.9	1.5	6.0	4.0	5.0	6.0		4.0	6.0	2.0	6.0
48	DYNAMIC STRENGTH	6	5.8	1.2	6.0	5.0	4.0	6.0			7.0		7.0
49	TRUNK STRENGTH	7	5.6	1.0	6.0	5.0	4.0	6.0			5.0	6.0	7.0
50	STAMINA	8	5.8	1.0	5.0	5.0	6.0	6.0		4.0	6.0	7.0	7.0

	MOS 97B	YES	MN	SD	51	41	82	2	40	69	23	22	27	?
1	ORAL COMPREHENSION	10	6.4	0.8	7.0	6.0	7.0	5.0	7.0	5.0	7.0	6.0	7.0	7.0
2	WRITTEN COMPREHENSION	10	6.2	1.1	7.0	5.0	7.0	4.0	7.0	5.0	7.0	6.0	7.0	7.0
3	ORAL EXPRESSION	10	6.4	1.0	7.0	6.0	7.0	4.0	7.0	6.0	7.0	6.0	7.0	7.0
4	WRITTEN EXPRESSION	10	6.6	0.7	7.0	6.5	7.0	5.0	7.0	6.0	7.0	6.0	7.0	7.0
5	MEMORIZATION	10	5.5	1.2	7.0	3.5	5.0	4.0	6.0	5.0	6.0	6.0	7.0	5.0
6	PROBLEM SENSITIVITY	9	5.6	1.0	7.0	5.0	5.0	4.0	5.5		6.0	6.0	7.0	5.0
7	ORGINALITY	9	5.4	1.3	6.0	5.0	6.0	2.0	6.0	6.0	6.0		6.0	6.0
8	FLUENCY OF IDEAS	9	5.4	0.9	5.0	5.0	6.0		4.0	6.0	5.0	5.0	6.0	7.0
9	FLEXIBILITY OF CLOSURE	10	4.9	0.7	6.0	5.0	5.0	5.0	4.0	5.0	4.0	5.0	6.0	4.0
10	SELECTIVE ATTENTION	10	5.5	1.0	6.0	5.0	6.0	5.0	4.0	7.0	4.0	6.0	6.0	6.0
11	SPATIAL ORIENTATION	9	4.3	1.0	5.0	4.0	4.0	4.0	3.0	4.0	4.0		6.5	4.0
12	VISUALIZATION	8	4.6	1.5	3.0	5.5	4.0	2.0		6.0		5.0	6.5	5.0
13	INDUCTIVE REASONING	8	5.9	1.0	7.0	6.0	7.0			6.0	4.0	6.0	6.5	5.0
14	CATEGORY FLEXIBILITY	4	5.4	0.8	5.0							5.0	6.5	5.0
15	DEDUCTIVE REASONING	10	5.7	1.0	6.0	6.0	7.0	4.0	6.5	5.0	4.0	6.0	6.5	6.0
16	INFORMATION ORDERING	10	5.6	1.0	6.0	5.0	7.0	4.0	6.0	6.0	4.0	5.0	6.5	6.0
17	MATH REASONING	3	4.0	1.7	2.0							5.0	5.0	
18	NUMBER FACILITY	4	3.9	1.7	2.0		3.0					5.0	5.5	
19	TIME SHARING	9	5.1	1.2	4.0	4.0	6.0		5.0	6.0	3.0	5.0	6.5	6.0
20	SPEED OF CLOSURE	9	5.1	0.8	5.0	4.0	5.0		5.0	5.0	6.0	5.0	6.5	4.0
21	PERCEPTUAL SPD & ACCY	7	4.6	1.4	4.0	4.5	3.0			4.0	6.0		7.0	4.0
22	REACTION TIME	3	4.3	2.3	3.0				3.0				7.0	
23	CHOICE REACTION TIME	6	4.5	1.6	5.0		4.0		5.0		4.0		7.0	2.0
24	NEAR VISION	8	4.3	1.3	3.0	4.0	4.0	3.0	4.0			5.0	7.0	4.0
25	FAR VISION	7	4.1	1.8	3.0	4.5		1.0	4.0			5.0	7.0	4.0
26	NIGHT VISION	8	4.3	1.4	4.0	4.5	4.0	2.0	4.0			5.0	7.0	4.0
27	VISUAL COLOR DISC	6	4.3	1.8	2.0	3.0			5.0			5.0	7.0	4.0
28	PERIPHERAL VISION	6	4.5	1.4	4.0	4.0			3.0			5.0	7.0	4.0
29	DEPTH PERCEPTION	7	4.1	1.5	3.0	4.0		3.0	3.0			5.0	7.0	4.0
30	GLARE SENSITIVITY	5	4.0	2.0	2.0	3.5			2.5			5.0	7.0	
31	GENERAL HEARING	9	4.2	1.5	4.0	4.5		2.5	6.0	3.0	3.0	5.0	7.0	3.0
32	AUDITORY ATTENTION	9	5.1	1.4	5.0	4.5	6.0	3.0	6.0	5.0	3.0	6.0	7.0	
33	SOUND LOCALIZATION	5	4.8	1.5	4.0				5.0		3.0	5.0	7.0	
34	CONTROL PRECISION	3	4.8	1.8	3.0	5.0							6.5	
35	RATE CONTROL	2	4.5	2.1	3.0								6.0	
36	WRIST-FINGER SPEED	7	4.4	1.7	2.0	6.0	5.0		5.0		2.0		6.0	5.0
37	FINGER DEXTERITY	9	4.1	1.5	2.0	5.0	5.0	2.0	4.0		3.0	5.0	6.0	5.0
38	MANUAL DEXTERITY	7	4.6	1.0	4.0	5.0			4.0		3.0	5.0	6.0	5.0
39	ARM-HAND STEADINESS	3	5.0	2.0							3.0	5.0	7.0	
40	MULTI-LIMB COORDINATION	6	4.0	1.8	2.0	4.0		3.0	3.0			5.0	7.0	
41	EXTENT FLEXIBILITY	3	4.0	2.6	2.0			3.0					7.0	
42	DYNAMIC FLEXIBILITY	3	4.7	2.5	2.0							5.0	7.0	
43	SPD OF LIMB MOVEMENT	1	7.0	####									7.0	
44	GROSS BODY EQUILIBRIUM	3	4.7	2.5	2.0							5.0	7.0	
45	GROSS BODY COORDINATN	3	5.0	2.0	3.0							5.0	7.0	
46	STATIC STRENGTH	2	5.5	0.7								5.0	6.0	
47	EXPLOSIVE STRENGTH	2	6.0	1.4								5.0	7.0	
48	DYNAMIC STRENGTH	3	5.0	2.0	3.0							5.0	7.0	
49	TRUNK STRENGTH	2	5.5	0.7								5.0	6.0	
50	STAMINA	4	4.9	1.0	5.0	3.5						5.0	6.0	

MOS 97E RAW AND SUMMARY DATA

	MOS 97E	YES	MN	SD	1	19	25	18	31	10	73	20	18	26
1	ORAL COMPREHENSION	10	6.7	0.5	7.0	6.0	7.0	7.0	6.0	7.0	7.0	6.0	7.0	7.0
2	WRITTEN COMPREHENSION	10	6.3	0.8	5.0	6.0	7.0	6.0	5.0	6.5	7.0	6.0	7.0	7.0
3	ORAL EXPRESSION	10	6.7	0.5	7.0	6.0	7.0	7.0	6.0	7.0	7.0	6.0	7.0	7.0
4	WRITTEN EXPRESSION	10	6.4	0.7	5.0	6.0	7.0	6.0	6.0	6.5	7.0	6.0	7.0	7.0
5	MEMORIZATION	9	5.8	1.1	4.0	5.0	5.0	6.0		7.0	5.0	7.0	6.0	7.0
6	PROBLEM SENSITIVITY	9	5.6	0.9	5.0	5.0	6.0	5.0		7.0	5.0	5.0	5.0	7.0
7	ORGINALITY	9	5.6	1.1	6.0	5.0	5.0	7.0	3.5	6.0		6.0	5.0	7.0
8	FLUENCY OF IDEAS	9	5.7	1.2	5.0	5.0	6.0	6.0		6.0	7.0	6.0	3.0	7.0
9	FLEXIBILITY OF CLOSURE	8	5.3	1.4	5.0	5.0	7.0	4.0	3.0			6.0	5.0	7.0
10	SELECTIVE ATTENTION	10	5.8	1.1	7.0	5.0	5.0	5.0	4.0	7.0	7.0	6.0	5.0	7.0
11	SPATIAL ORIENTATION	8	4.6	1.2	4.0	4.0		6.0	3.0	6.0	6.0	4.0		4.0
12	VISUALIZATION	5	5.7	1.6	3.0	6.0				5.5		7.0		7.0
13	INDUCTIVE REASONING	9	5.6	1.9	7.0	5.0	7.0	7.0		5.0	5.0	6.0	1.0	7.0
14	CATEGORY FLEXIBILITY	7	4.1	1.5	3.0	4.0	6.0	4.0				4.0	2.0	6.0
15	DEDUCTIVE REASONING	10	5.8	1.3	6.0	5.0	7.0	6.0	6.5	3.0	5.0	7.0	5.0	7.0
16	INFORMATION ORDERING	10	5.2	1.1	5.0	5.0	6.0	5.0	4.5	3.0	5.0	6.0	5.0	7.0
17	MATH REASONING	4	3.5	0.6			4.0	4.0		3.0				3.0
18	NUMBER FACILITY	6	4.2	1.8	2.0		5.0	5.0	3.0				3.0	7.0
19	TIME SHARING	8	4.9	1.5	5.0	3.0		6.0	2.5	6.0		5.0	5.0	7.0
20	SPEED OF CLOSURE	9	5.3	1.4	6.0	4.0	6.0	7.0		6.0	4.0	5.0	3.0	7.0
21	PERCEPTUAL SPD & ACCY	9	5.0	1.2	6.0	5.0	6.0	5.0		5.0	4.0	4.0	3.0	7.0
22	REACTION TIME	2	1.5	0.7	1.0									2.0
23	CHOICE REACTION TIME	1	2.0											2.0
24	NEAR VISION	8	4.6	1.7	4.0	6.0	2.0	5.0	3.0	4.0		6.0		7.0
25	FAR VISION	5	2.4	1.5	1.0	5.0	2.0					2.0		2.0
26	NIGHT VISION	6	3.8	1.0	2.0		4.0			4.0		5.0	4.0	4.0
27	VISUAL COLOR DISC	7	3.5	1.3	1.0		5.0	4.0	2.5	4.0		4.0		4.0
28	PERIPHERAL VISION	5	3.4	2.5	1.0			6.0				6.0	1.0	3.0
29	DEPTH PERCEPTION	2	1.5	0.7	2.0									1.0
30	GLARE SENSITIVITY	4	2.4	1.3						2.5		4.0	2.0	1.0
31	GENERAL HEARING	10	4.8	1.7	6.0	5.0	7.0	6.0	3.0	3.0	6.0	6.0	2.0	4.0
32	AUDITORY ATTENTION	9	5.7	1.1	7.0	4.0	7.0	5.0		5.0	5.0	5.0	6.0	7.0
33	SOUND LOCALIZATION	2	3.5	0.7	3.0									4.0
34	CONTROL PRECISION	2	1.5	0.7	2.0									1.0
35	RATE CONTROL	1	1.0											1.0
36	WRIST-FINGER SPEED	7	3.6	1.9	2.0	5.0	6.0	5.0				4.0	2.0	1.0
37	FINGER DEXTERITY	6	4.2	1.6	4.0	5.0	5.0	5.0				5.0		1.0
38	MANUAL DEXTERITY	3	3.7	2.3		5.0						5.0		1.0
39	ARM-HAND STEADINESS	2	2.5	2.1						4.0				1.0
40	MULTI-LIMB COORDINATION	2	2.5	2.1							4.0			1.0
41	EXTENT FLEXIBILITY	4	2.5	1.2	2.0				3.5	3.5				1.0
42	DYNAMIC FLEXIBILITY	1	1.0											1.0
43	SPD OF LIMB MOVEMENT	1	1.0											1.0
44	GROSS BODY EQUILIBRIUM	1	1.0											1.0
45	GROSS BODY COORDINATN	3	2.2	1.3	2.0					3.5				1.0
46	STATIC STRENGTH	2	2.3	1.8						3.5				1.0
47	EXPLOSIVE STRENGTH	2	2.5	2.1						4.0				1.0
48	DYNAMIC STRENGTH	2	1.8	1.1						2.5				1.0
49	TRUNK STRENGTH	2	2.0	1.4						3.0				1.0
50	STAMINA	1	1.0											1.0

	A	B	C	D	E	F	G	H	I	J	K	L	N	N
1		MOS 97G	YES	MN	SD	17	72	197	58	52	3	81	79	80
2	1	ORAL COMPREHENSION	9	6.0	1.0	4.0	6.0	7.0	6.5	6.5	7.0	5.8	6.0	5.0
3	2	WRITTEN COMPREHENSION	9	6.3	0.7	7.0	6.0	7.0	6.5	6.5	7.0	6.1	6.0	5.0
4	3	ORAL EXPRESSION	9	6.3	0.7	6.0	6.0	7.0	6.5	6.5	7.0	7.0	6.0	5.0
5	4	WRITTEN EXPRESSION	9	6.2	0.8	7.0	5.5	7.0	6.5	6.5	7.0	5.5	6.0	5.0
6														
7	5	MEMORIZATION	9	5.2	1.3	5.0	4.0	7.0	6.5	5.5	6.0	5.7	4.0	3.0
8	6	PROBLEM SENSITIVITY	9	5.5	0.8	4.0	6.0	6.0	6.5	6.0	5.0	5.2	6.0	5.0
9	7	ORGINALITY	8	5.5	1.4	3.0	4.0	7.0	6.5	6.0	5.0	6.1	6.0	
10	8	FLUENCY OF IDEAS	8	5.8	0.9	4.0	5.0	7.0	6.0	6.5	6.0	5.5	6.0	
11	9	FLEXIBILITY OF CLOSURE	8	5.9	1.2	7.0	4.0	5.0	7.0	7.0	5.0	6.9		5.0
12	10	SELECTIVE ATTENTION	9	5.8	0.8	5.0	6.0	5.0	7.0	7.0	5.0	6.2	6.0	5.0
13	11	SPATIAL ORIENTATION	8	5.3	0.9	6.0	4.0	5.0	7.0	5.0	5.0	5.1		5.0
14	12	VISUALIZATION	7	6.0	1.0		5.0		7.0	7.0	7.0	6.3	5.0	5.0
15														
16	13	INDUCTIVE REASONING	8	6.3	0.7	7.0	6.0		7.0	6.0	7.0	6.4	6.0	5.0
17	14	CATEGORY FLEXIBILITY	7	5.5	0.9	5.0	4.0		6.5	6.0	5.0	6.1	6.0	
18	15	DEDUCTIVE REASONING	9	6.0	1.2	7.0	6.0	6.0	7.0	6.0	7.0	5.9	6.0	3.0
19	16	INFORMATION ORDERING	9	5.6	1.4	7.0	5.0	4.0	7.0	6.0	7.0	5.2	6.0	3.0
20	17	MATH REASONING	8	4.6	1.2	3.0	4.0		6.0	5.0	5.0	5.9	3.0	5.0
21	18	NUMBER FACILITY	7	5.5	0.9	5.0	6.0		6.0	6.5	4.0	6.0		5.0
22														
23	19	TIME SHARING	8	5.7	1.0	4.0	5.0	5.0	6.5	6.5	7.0	6.3		5.0
24	20	SPEED OF CLOSURE	8	6.1	1.0	7.0	7.0	5.0	7.0	6.0	5.0	7.0		5.0
25	21	PERCEPTUAL SPD & ACCY	9	5.8	1.4	7.0	7.0	7.0	6.5	5.5	6.0	6.5	4.0	3.0
26	22	REACTION TIME	6	4.5	1.0	3.0	4.0		5.0	5.0		6.0	4.0	
27	23	CHOICE REACTION TIME	8	4.2	1.3	3.0	4.0	6.0	5.0	5.0	2.0	4.5	4.0	
28														
29	24	NEAR VISION	7	4.7	1.7	5.0	4.0		6.0	6.5	2.0	6.1		3.0
30	25	FAR VISION	6	4.7	1.0	5.0	4.0		6.0	5.0		5.2		3.0
31	26	NIGHT VISION	7	4.6	1.6	5.0	4.0		6.0	6.0	2.0	6.0		3.0
32	27	VISUAL COLOR DISC	6	5.2	0.8		5.0	4.0	6.0	6.0	5.0	4.9		
33	28	PERIPHERAL VISION	4	5.0	0.9		4.0		6.0	4.5		5.6		
34	29	DEPTH PERCEPTION	6	5.0	1.3	5.0	4.0		6.0	6.0		6.1		3.0
35	30	GLARE SENSITIVITY	4	4.7	0.5		4.0		5.0	5.0		4.9		
36														
37	31	GENERAL HEARING	8	5.9	0.8	5.0	5.0		5.0	6.5	7.0	6.9	6.0	6.0
38	32	AUDITORY ATTENTION	8	5.9	0.7		5.0	6.0	5.0	6.5	6.0	6.9	6.0	6.0
39	33	SOUND LOCALIZATION	6	5.4	1.0		4.0	6.0	5.0	5.5		6.8	5.0	
40														
41	34	CONTROL PRECISION	7	4.9	1.1	6.0	4.0	5.0	5.0	6.0		5.2		3.0
42	35	RATE CONTROL	5	4.7	0.8		4.0	5.0	4.5	6.0		4.1		
43	36	WRIST-FINGER SPEED	7	4.5	1.5		2.0	5.0	6.5	5.0		5.2	3.0	5.0
44	37	FINGER DEXTERITY	6	4.5	1.6		2.0		6.0	6.0		4.7	3.0	5.0
45	38	MANUAL DEXTERITY	7	4.2	1.5		2.0	5.0	6.0	5.0		5.2	3.0	3.0
46	39	ARM-HAND STEADINESS	5	4.2	1.5	4.0	2.0		4.0	5.5		5.6		
47	40	MULTI-LIMB COORDINATION	6	4.2	1.2	4.0	2.0	5.0	4.0	5.5		4.9		
48														
49	41	EXTENT FLEXIBILITY	6	4.4	1.3	5.0	2.0	5.0	4.0	5.0		5.5		
50	42	DYNAMIC FLEXIBILITY	4	3.6	1.3		2.0		4.0	5.0		3.2		
51	43	SPD OF LIMB MOVEMENT	6	4.0	1.3	3.0	2.0	5.0	4.0	5.5		4.2		
52	44	GROSS BODY EQUILIBRIUM	4	3.8	0.9		3.0		4.0	5.0		3.2		
53	45	GROSS BODY COORDINATN	4	3.9	0.9		3.0		4.0	5.0		3.4		
54	46	STATIC STRENGTH	8	4.0	1.2	5.0	2.0	5.0	4.0	5.5	3.0	4.2		3.0
55	47	EXPLOSIVE STRENGTH	4	3.9	1.4		2.0		4.0	5.5		4.1		
56	48	DYNAMIC STRENGTH	4	4.4	1.8		2.0		4.0	5.5		6.1		
57	49	TRUNK STRENGTH	4	4.5	1.9		2.0		4.0	5.5		6.3		
58	50	STAMINA	6	3.5	1.7	2.0	2.0		4.0	5.5		5.5	2.0	
59														

Appendix E

Part C Data

MOS 96B Part C Summary Data

	MOS 96B (N>=8)	Plan	Set-Up	Collect	Manage	Analyze	Interpret	Prepare	Dissem
1	ORAL COMPREHENSION	5.9		5.4			4.6		
2	WRITTEN COMPREHENSION	6.4		6.0	5.4	5.4	5.7		
3	ORAL EXPRESSION	6.1							6.2
4	WRITTEN EXPRESSION	5.3				5.8		5.7	6.7
5	MEMORIZATION	4.4						4.6	
6	PROBLEM SENSITIVITY	5.0	5.0			5.6			
7	ORGINALITY								
8	FLUENCY OF IDEAS	4.8						4.0	3.5
9	FLEXIBILITY OF CLOSURE								
10	SELECTIVE ATTENTION								
11	SPATIAL ORIENTATION								
12	VISUALIZATION						5.6		
13	INDUCTIVE REASONING					5.8			
14	CATEGORY FLEXIBILITY								
15	DEDUCTIVE REASONING	4.9				6.0	6.1		
16	INFORMATION ORDERING				4.9				
17	MATH REASONING								
18	NUMBER FACILITY								
19	TIME SHARING								
20	SPEED OF CLOSURE								
21	PERCEPTUAL SPD & ACCY								
22	REACTION TIME								
23	CHOICE REACTION TIME								
24	NEAR VISION								
25	FAR VISION								
26	NIGHT VISION								
27	VISUAL COLOR DISC								
28	PERIPHERAL VISION								
29	DEPTH PERCEPTION								
30	GLARE SENSITIVITY								
31	GENERAL HEARING								
32	AUDITORY ATTENTION								
33	SOUND LOCALIZATION								
34	CONTROL PRECISION								
35	RATE CONTROL								
36	WRIST-FINGER SPEED								
37	FINGER DEXTERITY								
38	MANUAL DEXTERITY								
39	ARM-HAND STEADINESS								
40	MULTI-LIMB COORDINATION								
41	EXTENT FLEXIBILITY								
42	DYNAMIC FLEXIBILITY								
43	SPD OF LIMB MOVEMENT								
44	GROSS BODY EQUILIBRIUM								
45	GROSS BODY COORDINATN								
46	STATIC STRENGTH								
47	EXPLOSIVE STRENGTH								
48	DYNAMIC STRENGTH								
49	TRUNK STRENGTH								
50	STAMINA								
	Mean	5.4	5.0	5.7	5.2	5.7	5.5	4.8	5.5
	s.d.	0.7		0.4	0.4	0.2	0.6	0.9	1.7

MOS 96D Part C Summary Data

	MOS 96D (N>=8)	Plan	Set-Up	Collect	Manage	Analyze	Interpret	Prepare	Dissem
1	ORAL COMPREHENSION	5.4	4.8	4.5			4.9		
2	WRITTEN COMPREHENSION	5.8		5.5		6.2	6.2		
3	ORAL EXPRESSION	5.6	5.4						6.6
4	WRITTEN EXPRESSION	5.8	5.1		5.2		6.1	6.9	6.8
5	MEMORIZATION					6.4	6.3		
6	PROBLEM SENSITIVITY				4.3	5.3			
7	ORGINALITY								
8	FLUENCY OF IDEAS								
9	FLEXIBILITY OF CLOSURE								
10	SELECTIVE ATTENTION			5.9	5.8	6.1	5.9	5.6	
11	SPATIAL ORIENTATION					5.5			
12	VISUALIZATION								
13	INDUCTIVE REASONING								
14	CATEGORY FLEXIBILITY								
15	DEDUCTIVE REASONING					6.4	6.8		
16	INFORMATION ORDERING	5.1	4.6	5.6	5.6		6.2	5.4	
17	MATH REASONING					6.7	6.8		
18	NUMBER FACILITY	5.2	5.0			6.4	6.2		
19	TIME SHARING			5.9					
20	SPEED OF CLOSURE								
21	PERCEPTUAL SPD & ACCY					6.1	6.3	5.0	4.7
22	REACTION TIME								
23	CHOICE REACTION TIME								
24	NEAR VISION					6.8	6.8		
25	FAR VISION					6.4	6.4		
26	NIGHT VISION								
27	VISUAL COLOR DISC								
28	PERIPHERAL VISION								
29	DEPTH PERCEPTION					6.8	6.9		
30	GLARE SENSITIVITY								
31	GENERAL HEARING								
32	AUDITORY ATTENTION								
33	SOUND LOCALIZATION								
34	CONTROL PRECISION								
35	RATE CONTROL								
36	WRIST-FINGER SPEED								
37	FINGER DEXTERITY								
38	MANUAL DEXTERITY								
39	ARM-HAND STEADINESS								
40	MULTI-LIMB COORDINATION								
41	EXTENT FLEXIBILITY								
42	DYNAMIC FLEXIBILITY								
43	SPD OF LIMB MOVEMENT								
44	GROSS BODY EQUILIBRIUM								
45	GROSS BODY COORDINATN								
46	STATIC STRENGTH								
47	EXPLOSIVE STRENGTH								
48	DYNAMIC STRENGTH								
49	TRUNK STRENGTH								
50	STAMINA								
	Mean	5.5	5.0	5.5	5.2	6.3	6.3	5.7	6.0
	s.d.	0.3	0.3	0.6	0.7	0.5	0.5	0.8	1.2

MOS 96H Part C Summary Data

	MOS 96H (N>=7)	Plan	Set Up	Collect	Manage	Analyze	Interpret	Prepare	Dissem
1	ORAL COMPREHENSION	5.1	4.9						4.3
2	WRITTEN COMPREHENSION	4.9	4.9						3.6
3	ORAL EXPRESSION	4.4	5.5						4.4
4	WRITTEN EXPRESSION	4.3						3.0	3.6
5	MEMORIZATION	4.9	4.4						
6	PROBLEM SENSITIVITY		4.6						
7	ORGINALITY								
8	FLUENCY OF IDEAS	3.7							
9	FLEXIBILITY OF CLOSURE			5.1					
10	SELECTIVE ATTENTION			5.3					
11	SPATIAL ORIENTATION			5.6					
12	VISUALIZATION								
13	INDUCTIVE REASONING			3.7					
14	CATEGORY FLEXIBILITY								
15	DEDUCTIVE REASONING	4.4	4.1						
16	INFORMATION ORDERING	4.9	4.9						
17	MATH REASONING	3.6	3.4						
18	NUMBER FACILITY	4.0							
19	TIME SHARING		4.1	4.8					
20	SPEED OF CLOSURE			4.7					
21	PERCEPTUAL SPD & ACCY			5.4					
22	REACTION TIME								
23	CHOICE REACTION TIME			5.1					
24	NEAR VISION		4.3	1.3					
25	FAR VISION			6.4					
26	NIGHT VISION			6.1					
27	VISUAL COLOR DISC			5.5					
28	PERIPHERAL VISION			5.9					
29	DEPTH PERCEPTION			5.4					
30	GLARE SENSITIVITY			5.1					
31	GENERAL HEARING			5.5					
32	AUDITORY ATTENTION								
33	SOUND LOCALIZATION								
34	CONTROL PRECISION			4.1					
35	RATE CONTROL								
36	WRIST-FINGER SPEED								
37	FINGER DEXTERITY								
38	MANUAL DEXTERITY								
39	ARM-HAND STEADINESS								
40	MULTI-LIMB COORDINATION								
41	EXTENT FLEXIBILITY			4.6					
42	DYNAMIC FLEXIBILITY								
43	SPD OF LIMB MOVEMENT								
44	GROSS BODY EQUILIBRIUM								
45	GROSS BODY COORDINATN								
46	STATIC STRENGTH								
47	EXPLOSIVE STRENGTH								
48	DYNAMIC STRENGTH								
49	TRUNK STRENGTH								
50	STAMINA								
	Mean	4.4	4.5	5.0				3.0	4.0
	s.d.	0.5	0.6	1.1					0.5

MOS 96R Part C Summary Data

	MOS 96R (N>=8)	Plan	Set-Up	Collect	Manage	Analyze	Interpret	Prepare	Dissem
1	ORAL COMPREHENSION	4.8	5.0					4.3	4.6
2	WRITTEN COMPREHENSION	5.0	4.3	5.3	5.1	5.3	5.6	4.3	4.6
3	ORAL EXPRESSION	4.8	4.7	4.8	5.1	5.4	5.5	5.2	5.3
4	WRITTEN EXPRESSION		5.0					5.7	
5	MEMORIZATION	5.4	5.3	5.3					
6	PROBLEM SENSITIVITY	4.9	5.7			5.0	4.6	4.8	4.8
7	ORIGINALITY								
8	FLUENCY OF IDEAS								
9	FLEXIBILITY OF CLOSURE			5.2		4.6	5.3		
10	SELECTIVE ATTENTION			5.6			5.9	5.4	5.4
11	SPATIAL ORIENTATION		5.7	5.4					
12	VISUALIZATION	5.2	5.8			5.3			
13	INDUCTIVE REASONING			5.3					
14	CATEGORY FLEXIBILITY								
15	DEDUCTIVE REASONING			5.0					4.6
16	INFORMATION ORDERING								
17	MATH REASONING		5.1	4.8	4.8		4.4	4.8	4.2
18	NUMBER FACILITY		4.7		4.8		4.7	4.7	4.5
19	TIME SHARING			5.4	4.9		4.9		4.9
20	SPEED OF CLOSURE		4.8			4.7			
21	PERCEPTUAL SPD & ACCY			5.4			4.9	4.4	4.4
22	REACTION TIME			5.5	5.3	5.0	4.9	4.6	5.3
23	CHOICE REACTION TIME			6.1					
24	NEAR VISION		4.6	4.9				4.5	4.4
25	FAR VISION		5.1						
26	NIGHT VISION		5.9	5.6				5.6	
27	VISUAL COLOR DISC								
28	PERIPHERAL VISION		5.4						
29	DEPTH PERCEPTION		5.0	5.3					
30	GLARE SENSITIVITY		4.7	4.8					
31	GENERAL HEARING			5.9			5.4		
32	AUDITORY ATTENTION			5.7					
33	SOUND LOCALIZATION			5.6					
34	CONTROL PRECISION			5.6			5.1	4.3	4.4
35	RATE CONTROL		5.4			5.0			
36	WRIST-FINGER SPEED		5.6	5.8					
37	FINGER DEXTERITY		5.4	5.8		4.8			
38	MANUAL DEXTERITY		5.6						
39	ARM-HAND STEADINESS		5.3						
40	MULTI-LIMB COORDINATION		5.9						
41	EXTENT FLEXIBILITY								
42	DYNAMIC FLEXIBILITY								
43	SPD OF LIMB MOVEMENT			5.2	5.8				
44	GROSS BODY EQUILIBRIUM			5.1					
45	GROSS BODY COORDINATN								
46	STATIC STRENGTH			5.7					
47	EXPLOSIVE STRENGTH			5.7					
48	DYNAMIC STRENGTH								
49	TRUNK STRENGTH								
50	STAMINA								
	Mean	5.1	5.2	5.4	5.1	5.0	5.1	4.8	4.7
	s.d.	0.3	0.3	0.4	0.4	0.3	0.4	0.5	0.4

MOS 97B Part C Summary Data

	MOS 97B (N>=8)	Plan	Set-Up	Collect	Manage	Analyze	Interpret	Prepare	Dissem
1	ORAL COMPREHENSION			1.2			5.6		
2	WRITTEN COMPREHENSION					5.5	5.9		
3	ORAL EXPRESSION	4.6	5.0	5.2					5.3
4	WRITTEN EXPRESSION				5.2	4.6	5.3	6.3	5.2
5	MEMORIZATION								
6	PROBLEM SENSITIVITY	4.9				4.8	5.1		
7	ORGINALITY								
8	FLUENCY OF IDEAS								
9	FLEXIBILITY OF CLOSURE					5.3	4.6		
10	SELECTIVE ATTENTION			4.6		4.6			
11	SPATIAL ORIENTATION	3.8							
12	VISUALIZATION								
13	INDUCTIVE REASONING								
14	CATEGORY FLEXIBILITY								
15	DEDUCTIVE REASONING	5.1				5.8	5.7		
16	INFORMATION ORDERING	5.5		4.1	5.2			5.6	
17	MATH REASONING								
18	NUMBER FACILITY								
19	TIME SHARING								
20	SPEED OF CLOSURE			4.5			4.5		
21	PERCEPTUAL SPD & ACCY								
22	REACTION TIME								
23	CHOICE REACTION TIME								
24	NEAR VISION								
25	FAR VISION								
26	NIGHT VISION								
27	VISUAL COLOR DISC								
28	PERIPHERAL VISION								
29	DEPTH PERCEPTION								
30	GLARE SENSITIVITY								
31	GENERAL HEARING								
32	AUDITORY ATTENTION								
33	SOUND LOCALIZATION								
34	CONTROL PRECISION								
35	RATE CONTROL								
36	WRIST-FINGER SPEED								
37	FINGER DEXTERITY							4.1	
38	MANUAL DEXTERITY								
39	ARM-HAND STEADINESS								
40	MULTI-LIMB COORDINATION								
41	EXTENT FLEXIBILITY								
42	DYNAMIC FLEXIBILITY								
43	SPD OF LIMB MOVEMENT								
44	GROSS BODY EQUILIBRIUM								
45	GROSS BODY COORDINATN								
46	STATIC STRENGTH								
47	EXPLOSIVE STRENGTH								
48	DYNAMIC STRENGTH								
49	TRUNK STRENGTH								
50	STAMINA								
	Mean	4.8	5.0	3.9	5.2	5.1	5.2	5.3	5.3
	s.d.	0.6		1.6	0.0	0.5	0.5	1.1	0.1

MOS 97E Part C Summary Data

	MOS 97E (N>=8)	Plan	Set-Up	Collect	Manage	Analyze	Interpret	Prepare	Dissem
1	ORAL COMPREHENSION	6.1	5.3	7.0	5.1	4.4	4.6	4.2	5.0
2	WRITTEN COMPREHENSION	5.9	5.8	5.8	4.8	4.9	4.5	5.2	5.7
3	ORAL EXPRESSION	5.0	4.7	6.9	4.6	4.5	4.3	4.4	5.5
4	WRITTEN EXPRESSION	5.0	4.5	5.2	6.0	5.2	4.1	5.9	6.0
5	MEMORIZATION	6.0	5.6	6.0	5.2	5.2	4.5	4.0	4.0
6	PROBLEM SENSITIVITY	4.8	4.1	5.2	4.5	4.5	4.7	4.3	4.1
7	ORGINALITY	5.2	4.8	6.1	4.0	4.3	4.3	4.5	4.5
8	FLUENCY OF IDEAS	5.0	4.1	5.5	3.8	3.7	5.0	4.7	4.8
9	FLEXIBILITY OF CLOSURE								
10	SELECTIVE ATTENTION	4.3	3.8	6.4	4.7	4.3	3.8	4.5	4.1
11	SPATIAL ORIENTATION			4.9					
12	VISUALIZATION								
13	INDUCTIVE REASONING	5.5	4.6	5.8	5.2	5.6	5.6	5.3	4.0
14	CATEGORY FLEXIBILITY								
15	DEDUCTIVE REASONING	5.0	4.4	5.6	4.7	4.9	5.0	4.4	4.5
16	INFORMATION ORDERING	4.4	4.2	4.8	4.8	4.0	3.6	4.7	4.0
17	MATH REASONING								
18	NUMBER FACILITY			4.8					
19	TIME SHARING	4.6	4.5	5.0					
20	SPEED OF CLOSURE	4.8	4.6	6.1	5.0	4.6		4.0	3.5
21	PERCEPTUAL SPD & ACCY			5.6					
22	REACTION TIME								
23	CHOICE REACTION TIME								
24	NEAR VISION			5.0					
25	FAR VISION								
26	NIGHT VISION								
27	VISUAL COLOR DISC								
28	PERIPHERAL VISION								
29	DEPTH PERCEPTION								
30	GLARE SENSITIVITY								
31	GENERAL HEARING	2.3	2.3	5.4	2.4	2.5	3.1	2.3	2.7
32	AUDITORY ATTENTION	3.0	3.0	5.7	3.8	4.2	3.2	3.0	3.1
33	SOUND LOCALIZATION								
34	CONTROL PRECISION								
35	RATE CONTROL								
36	WRIST-FINGER SPEED								
37	FINGER DEXTERITY								
38	MANUAL DEXTERITY								
39	ARM-HAND STEADINESS								
40	MULTI-LIMB COORDINATION								
41	EXTENT FLEXIBILITY								
42	DYNAMIC FLEXIBILITY								
43	SPD OF LIMB MOVEMENT								
44	GROSS BODY EQUILIBRIUM								
45	GROSS BODY COORDINATN								
46	STATIC STRENGTH								
47	EXPLOSIVE STRENGTH								
48	DYNAMIC STRENGTH								
49	TRUNK STRENGTH								
50	STAMINA								
	Mean	4.8	4.4	5.6	4.6	4.5	4.3	4.4	4.4
	s.d.	1.0	0.9	0.6	0.8	0.7	0.7	0.9	0.9

MOS 97G Part C Summary Data

	MOS 97G (N>=8)	Plan	Set-Up	Collect	Manage	Analyze	Interpret	Prepare	Dissem
1	ORAL COMPREHENSION	5.3	4.8	5.8	5.3	5.9	5.9	6.1	5.4
2	WRITTEN COMPREHENSION	5.7	5.3	6.1	6.1	5.9	6.0	6.6	5.7
3	ORAL EXPRESSION	6.0	6.0	5.0	5.3	5.7	4.5	5.5	6.7
4	WRITTEN EXPRESSION	5.9	5.2	5.8	5.4	6.1	5.7	6.4	5.2
5	MEMORIZATION	5.3	4.4	4.5	5.2	4.0	4.7	4.1	4.0
6	PROBLEM SENSITIVITY	5.3	5.4	5.3	5.4	6.0	5.5	5.1	4.7
7	ORGINALITY	5.4	5.4	5.6	4.9	5.5	5.1	5.1	4.8
8	FLUENCY OF IDEAS	5.1	5.4	4.9	4.4	5.5	5.5	4.5	4.0
9	FLEXIBILITY OF CLOSURE	4.8	4.6	5.8	5.1	6.5	6.6	5.2	5.0
10	SELECTIVE ATTENTION	5.1	5.4	6.1	5.4	6.3	6.2	5.0	4.3
11	SPATIAL ORIENTATION	3.9	4.9	3.9	3.6	4.9	4.7	3.2	3.2
12	VISUALIZATION								
13	INDUCTIVE REASONING	5.3	5.0	6.5	6.1	6.4	6.2	5.7	4.9
14	CATEGORY FLEXIBILITY								
15	DEDUCTIVE REASONING	5.8	5.3	5.6	5.4	5.8	5.5	5.5	4.8
16	INFORMATION ORDERING	4.8	4.7	5.1	5.2	5.0	4.9	5.1	4.8
17	MATH REASONING	4.4	4.3	5.1	4.4	4.9	4.6	4.2	3.8
18	NUMBER FACILITY								
19	TIME SHARING	5.4	5.3	6.0	5.3	5.9	6.0	5.4	4.9
20	SPEED OF CLOSURE	4.9	4.9	6.3	6.0	6.5	6.1	5.3	4.8
21	PERCEPTUAL SPD & ACCY	4.2	4.4	5.1	4.5	5.6	5.4	4.9	4.3
22	REACTION TIME								
23	CHOICE REACTION TIME		3.2	4.4	4.4	3.8			
24	NEAR VISION								
25	FAR VISION								
26	NIGHT VISION								
27	VISUAL COLOR DISC								
28	PERIPHERAL VISION								
29	DEPTH PERCEPTION								
30	GLARE SENSITIVITY								
31	GENERAL HEARING	3.8	3.9	5.9	4.7	5.9	5.5	4.2	4.0
32	AUDITORY ATTENTION		4.4	6.1	5.7	6.1	6.1	4.8	4.3
33	SOUND LOCALIZATION								
34	CONTROL PRECISION								
35	RATE CONTROL								
36	WRIST-FINGER SPEED								
37	FINGER DEXTERITY								
38	MANUAL DEXTERITY								
39	ARM-HAND STEADINESS								
40	MULTI-LIMB COORDINATION								
41	EXTENT FLEXIBILITY								
42	DYNAMIC FLEXIBILITY								
43	SPD OF LIMB MOVEMENT								
44	GROSS BODY EQUILIBRIUM								
45	GROSS BODY COORDINATN								
46	STATIC STRENGTH								
47	EXPLOSIVE STRENGTH								
48	DYNAMIC STRENGTH								
49	TRUNK STRENGTH								
50	STAMINA								
	Mean	5.1	4.9	5.5	5.1	5.6	5.5	5.1	4.7
	s.d.	0.6	0.6	0.7	0.6	0.7	0.6	0.8	0.8